ELECTRICAL REVIEW

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 4, No. 19. WEEKLY. NEW YORK, SATURDAY, JULY 12, 1884. $3 per annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

Dynamos for Electroplating.

In discussing the general favorable progress now being made in the electrical field, our esteemed contemporary, *Manufacturer and Builder*, justly says that while public interest in electrical matters is centered principally upon the advances that have been made in the applications to lighting, there are other industrial applications in which the advances of electrical science have created almost a complete revolution; but as these evidences of progress do not render themselves obvious to the eye, the public knows comparatively little about them.

Of the industries that have profited greatly by the great advances in electrical science, none has received so great an impulse as the art of electroplating. This has been brought about within the past ten years or thereabouts, by reason of the great improvements that have been made within that period in the construction and efficiency of dynamo-electric machines, by which mechanical energy, generated by the steam engine, or other convenient source of power, may be directly converted into electrical energy.

The advantages of these machines as the source of electric current over the voltaic battery in its various forms, are numerous and decided.

The battery, at the best, is expensive to maintain and troublesome to manage; it only gives out its full power when freshly charged, and as the chemical actions—upon which it relies for its power—progress, it deteriorates in strength, and requires to be reinvigorated by frequent renewals of zincs or carbons, or additions of acids or salts, or to be freshly charged; and its use demands constant vigilance and attention.

From these and other objectionable features the dynamo-electric machine is almost wholly exempt. The source of power is under such control that electrical currents of any required degree of strength may be instantly generated by simply throwing on a belt, and maintained with practically perfect uniformity for hours at a time.

The amount of attention required in its operation is infinitesimal as compared with the constant watchfulness demanded by the battery, rendering the machine vastly more convenient to use; and the rapidity with which large quantities of metal may be deposited by the machine, with a comparatively small consumption of mechanical power, renders it a much more economical source of electrical current.

The importance of adapting machines of this class to the work of electrotyping and electroplating has been steadily kept in mind by successive inventors, and the result has been the production of plating machines that answer, so satisfactorily, every reasonable requirement of the electrotyper, that to-day there is scarcely an electrotyping or electroplating establishment, worthy to be dignified by the name, that has not discarded the voltaic battery and adopted one or the other of the many varieties of the dynamo-electric machine in its place.

As a surplus of steam power is frequently at hand in all the larger establishments, for driving presses, lathes, grinding and polishing wheels, etc., the few horse-powers, more or less, taken off by one or several plating machines, is an item that scarcely makes itself felt in the expense account.

Finally, the constancy, completeness of control, and cheapness of the dynamo, as compared with the uncertain, troublesome, and comparatively expensive voltaic battery, has not only, as above remarked, secured its almost universal introduction among electrotypers and electroplaters, and greatly extended the magnitude of the electroplating industries by cheapening the cost of their products, but, as all authorities on the subject concur in affirming, has been the principal agency in calling into existence what is

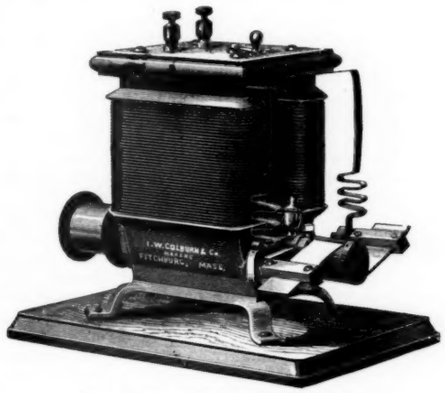

FIG. 1.—COLBURN PLATING MACHINE.

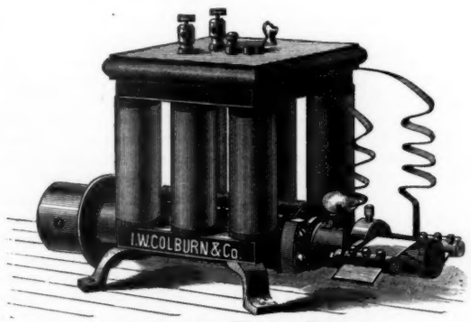

FIG. 2.—COLBURN PLATING MACHINE.

to-day one of the most successful and useful branches of the art—namely, that of nickel-plating, which, without the dynamo, would never have attained to the leading position it occupies to-day.

We show in the accompanying illustrations (Figs. 1 and 2) two varieties of the so-called plating machines, which are manufactured by I. W. Colburn & Co., of Fitchburg, Mass., whose hand-power dynamo was described in one of our recent issues.

The current of these machines is under complete control, and can be uniformly maintained at the smallest desired strength, or up to its full capacity, according to the character and quantity of the work in the depositing vats. The armature is very exactly balanced, and is of very soft iron, which permits it to be rapidly magnetized and demagnetized. They are affirmed to be so constructed as to be proof against heating (which is one of the principal sources of loss of power in machines of this class), and against reversal of current by the polarization of the electrodes in the depositing vats (which is a common source of trouble, and occasionally of damage with plating machines of bad design). The Colburn plating machines are provided with long journals, running in self-oiling composition bearings. The commutator (a device for collecting the alternating currents generated by the machine, and sending them in the same direction) is outside the bearings, and is provided with wide brushes, which can be adjusted to any desired angle.

These machines have been very thoroughly tested in depositing silver and nickel, and are claimed to be capable of depositing a large quantity of metal for the power consumed in operating them. All manufacturers of dynamo machines for electroplating have made commendable progress during the past year, and doubtless perfection is nearly attained.

A Catastrophe Averted by Electric Wires.

The drill hall of the State University, at Minneapolis, was struck by lightning, on the 12th of June, with attendant phenomena of interest. This building, locally known as the University Colosseum, stands on a bluff overlooking the Falls of St. Anthony, occupying the highest ground in the city. A musical festival was in progress at the time; choruses from Minneapolis and St. Paul being assisted by Nilsson, Materna, and other celebrities, under the general direction of Dr. Theodore Thomas. At 2 P. M. there were 1,000 children assembled on the stage, and about 3,000 persons in the audience. A thunder storm arose, and while the children's choruses were going on, it was noticed that the series of electric lamps, fifteen in number, hanging from the dome, were lighted at each flash of lightning, going out again at once, and there was a sense of uneasiness pervading the people.

Herr Scaria had just opened the rear door of the stage, a solo from him being next in order, when suddenly there was a loud report, as if of heavy ordnance, balls of fire were distinctly seen through the large skylight, and following the electric wires away from the building. Subsequent examination showed that the lightning first struck the flag staff surmounting the door, thence pierced an oaken beam to which the staff was fastened, the splinters, or the concussion, breaking the glass in the skylight. An iron rod conducted the fluid to the network of electric wires below, where the charge was divided, a portion being harmlessly distributed over the general circuit, and the remainder shattering several electric masts near the building.

A workman on the roof had his shoe torn off, and his leg badly burned; and another person in proximity to one of the masts was temporarily paralyzed; two or three ladies fainted away; but that was all the damage sustained. There was a panic imminent at first, as every one instinctively sprang to his feet and confused cries and shouts were uttered. Had those 4,000 people made a rush for the doors, many lives must have been sacrificed. But they were mostly persons of education, trained to obey orders, and accordingly, when told to sit down, they immediately did so. Dr. Thomas, with great presence of mind, had his orchestra play, and Herr Scaria came forward and sang. Thus reassured, people either remained to hear the music, or quietly left the hall. It should be added that, at night, the Colosseum was crowded to its utmost capacity to hear the oratorio of the Creation, and quietly sat through another thunder storm, seemingly satisfied that the electric wires were good lightning rods. The lamps, however, worked fitfully, now blazing with startling brilliancy, and then going completely out, leaving the audience in total darkness, and then flashing up again. Meanwhile the music went on as if nothing unusual had occurred, both soloists and chorus being perfectly familiar with the score.

An impression seems to have gained ground that the lightning was attracted by "the nest of electric wires" clustered in the upper part of the University Colosseum. There is no such "nest," only a pair of insulated copper wires running through the building above the ceiling. What drew the lightning was the metallic ball surmounting the tall flagstaff, fifty feet from the wires. The staff and girder to which it was attached were wet, hence became conductors, carrying the fluid along to an iron bolt, beside which it passed through a heavy piece of timber, whence it leaped upon the electric wires, by means of which it escaped from the building. There is not the slightest doubt that the wires performed the duty of

lightning rods in this instance, although not put up for that purpose. Nor is there any doubt of the grave error of permitting a vast assembly to be gathered into a lofty building on an eminence, the dome surmounted by a staff tipped with a metallic globe, whereby the lightning was actually invited, with no provision intentionally made for its escape. The intensity of the current fused the fine wire circuit feeding the lamps, which, according to Secretary King, of the Electric Light Company, accounted for the spasmodic working of the lamps at the concert on Thursday night—the wonder being that they should have worked at all after being subjected to such a strain.

Mr. Noyes, foreman of the Brush Company, tells an interesting experience. He was at work on the wires previous to the storm, and kept on after it burst, although aware of his danger. At the moment the building was struck, he was splicing the wires directly above the central lamp, meanwhile taking every precaution possible under the circumstances. For a few minutes he lay unconscious, and then regaining his senses descended to the ground. He says that he did not feel any pain until he reached *terra firma*, when he suffered intensely in his right foot. On examination he found that the bolt had struck his leg below the knee, tearing the clothing to shreds, bursting open his stout boot from heel to toe, and blistering the flesh as if with a hot iron.

The Iridium Industry.

This metal has been known since the year 1803, having been discovered by Smithson Tennent while investigating the metallic residue which remained when platinum ores were dissolved in aqua regia. The metal is classed among the rare metals, as it is not found in large quantities, although it is quite widely distributed geographically. It is found in California, Oregon, Russia, East India, Borneo, South America, Canada, Australia, and in certain parts of France, Germany, and Spain. The principal sources of supply of the metal are Russia and California; it is nearly always found with either platinum or gold, is extracted from those ores as a by-product, and is always found in small grains or fine powder, the largest pieces being the size of a grain of rice. In nature it is generally alloyed with other metals, and the two metals with which it is most commonly alloyed are platinum and osmium; the platinum alloy is called platin-iridium, and the osmium alloy osmiridium, or iridosmine. The grains of platin-iridium are sometimes found as small cubes with rounded edges, while the iridosmine usually exists in the form of flat irregular grains and occasionally as hexagonal prisms The supply of metal which is derived from Russia is generally obtained from the platinum mines which are situated in the Ural Mountains; while in California it is found principally in the placer gold washings. The ores of iridium are a source of great annoyance when mixed with gold-dust on account of its specific gravity, which is about 19.3, being nearly the same as that of gold. Consequently, it is impossible to separate the gold from the iridium by the process of washing; the separation may, however, be made either by the amalgamation of the gold (as neither iridium nor its ores combine with mercury), or by dissolving out the gold in aqua regia.

In the mints these metals are frequently separated by melting the gold-dust and allowing the molten mass to remain in the crucible for some time, during which the iridium slowly settles to the bottom as it does not alloy with the gold under such circumstances. The gold is then poured off from the top, and the dregs in the bottom of the crucible are found to contain the greater quantity of the iridium The gold contained in the dregs is then dissolved and the iridium is found in the residue.

In Russia it is contrary to the law to possess or deal in iridium ore, and, consequently, the government takes possession of all the ore which is mined or extracted from the platinum ores in that country, and it is stored in the vaults of the Royal Mint. The reason for the law is, that some years ago the Russian government found that speculators in gold-dust would sometimes add iridium to it (which often escaped detection by the officials of the mint), for the purpose of increasing its weight. On attempting to work this gold they found the fine particles of iridium distributed through the ingots; on rolling the ingots into sheets, these individual grains or particles produced indentations in their steel rolls; and in striking out the coins the dies were marred and defaced, thus causing considerable loss to the government. In order to prevent this species of fraud, the government passed a law prohibiting persons from handling the metal in any way and compelling its immediate surrender.

For a number of years experimenters have endeavored to melt the iridosmine or iridium in order to utilize it in the arts for such purposes as could with advantage employ a metal of its wonderful properties; but until lately success has been only partial.

I may here briefly describe the properties of the metal itself. Iridium possesses a white luster, resembling that of steel; its hardness is about equal to that of the ruby; in the cold it is quite brittle, but at a white heat it is somewhat malleable. It is one of the heaviest of metals, having a specific gravity of 22.38. When heated in the air to a red heat the metal is very slowly oxidized; but upon raising the temperature to about 1,000 C., it parts with its oxygen, and hence at a high heat (above 1,000 C.), it is not oxidized. It is insoluble in all single acids, but is very slightly soluble in aqua regia after being heated in the state of fine powder for many hours. In a massive state, however, aqua regia does not attack it.

In attempting to fuse iridium heretofore, it has been found by experimenters that the best results that could be obtained were by means of the oxy-hydrogen or electric furnaces, but that with either of these means of fusion they could only work a very small quantity of the metal at a time, and obtain a globule of very small size. Previous to the present time iridium has had substantially but one use (with the exception of alloying with platinum), viz., for pointing gold pens. The iridium point is commonly called "diamond point" upon a gold pen, and it consists simply of a small grain of iridosmine which has been selected for the purpose, and soldered to the tip of the pen. These are selected by first removing from the ore, with a magnet, the magnetic oxide of iron which always accompanies it, and then dissolving out by means of acids, the other impurities which may be present; the ore is then washed with water, dried and sifted in order to remove the fine dust, and the sifted ore is then ready for the selection of points. This is done by an operator, who rolls the grains of iridium around with a needle point, examining them under a magnifying glass, and selecting those which are solid, compact, and of the proper size and shape. These points are usually selected in three grades, small, medium, and large, depending upon the size of the pen for which they are intended to be used. The grain of iridium having been soldered on to the end of the pen, it is sawed in two (which makes the two nibs of the pen), and ground up in the proper shape.

About four years ago Mr. John Holland, the well known gold pen manufacturer, found it necessary to have pieces of iridium larger than those generally found in nature for the purpose of making points for the Mackinnon stylographic pen. After many experiments he found that by heating the ore in a Hessian crucible to a white heat and adding to it phosphorus, and continuing the heating for a few minutes, he could obtain a perfect fusion of the metal, which could be poured out and cast into almost any desired shape. This material was found on physical examination to be about as hard as the natural grains of iridium; and in fact seemed to have all the properties of the metal itself. On chemical analysis it was found that the metal fused with phosphorus contained, according to two determinations, 7.52 per cent. and 7.74 per cent. of phosphorus. At this stage of the discovery we became acquainted with it, and began experiments with the intention of putting the product to some practical use in the arts. It was found that the presence of phosphorus rendered the metal quite readily fusible at a white heat, but this, of course, was an obstacle in the way of its use for electrical purposes. Desiring, therefore, to remove the phosphorus, we found by experimenting that by heating the metal in a bed of lime the phosphorus could be completely removed. In this operation, the metal is first heated in an ordinary furnace to a white heat, and finally, after no more phosphorus makes its appearance, it is removed and placed in an electric furnace with a lime crucible and there heated until the last traces of phosphorus are removed; the metal which then remains will resist as much heat without fusion as the native metal.

In mechanical applications, where the metal is not subject to great heat, it is melted with phosphorus and cast into the shape desired, and then ground or worked as the application may require. The first application to which it was put was the manufacture of the Mackinnon pen-points. For this purpose, the metal, after being fused, is removed from the furnace and poured between two slabs of iron which are kept apart the desired distance so as to make a sheet of iridium of the thickness required. The metal is poured, as I have said, between these plates, and the plates are brought suddenly together, on the plan of a closed ingot with a hinge, so that as the metal cools it is subjected to pressure which closes the pores and makes a very compact casting. The slabs for the Mackinnon pen-points are about one thirty-second of an inch in thickness, and are broken up into small irregular pieces which are soldered on a strip of brass and ground down to a flat surface by means of a copper-lap consisting of a plate of copper, about one-half inch in thickness and eight inches in diameter, fixed on a spindle which is made to revolve from eight hundred to a thousand revolutions per minute; the copper of which the lap is composed is wrought copper, well annealed, and consequently very soft. In order to grind with it, corundum or diamond-dust is mixed with oil and applied to the flat surface of the lap by means of a flat steel instrument, upon which pressure is applied in order to force the corundum or diamond-dust into the copper, thereby making a cutting surface. The iridium to be ground is held against this sharp surface of the lap, and the corundum or diamond-dust gradually cuts the metal away. As the cutting material wears from the copper-lap, another application of the corundum and diamond-dust is made by means of the steel instrument as described; this operation is continued until the grinding is complete. After the slabs are ground to a surface they are then drilled. In the drilling operation, the iridium is first countersunk by means of a diamond drill, consisting of an upright spindle suitably fixed in a frame so as to revolve freely; the bottom of the spindle holds a small rod of brass, to the lower end of which is set a white diamond-splint. This drill is made to revolve about nine hundred revolutions per minute. The iridium is held up against the diamond with a light pressure, and the diamond gradually makes a conical hole or countersink. After countersinking the iridium, it is finally pierced by means of a copper drill which consists of a piece of soft copper wire, which is filed down to a point and set in a drill similar to that in which the diamond is placed, but this drill makes about thirty-five hundred revolutions per minute. Corundum or diamond-dust and oil is put into the countersink opening in the iridium, and then it is held up against the piece of revolving copper. The diamond-dust or corundum, imbedding itself in the copper, acts as a cutting surface, and finally accomplishes the drilling of the hole. The holes having been drilled in the pieces of iridium which were soldered to the brass, the brass is finally dissolved from the iridium by means of nitric acid; and then we have irregular-shaped pieces of iridium, pierced with holes. These pieces of iridium are then soldered in proper position to the end of the Mackinnon pen, fitting into the opening of which there is a valve consisting of an iridium-pointed wire.

I may mention briefly some of the uses to which iridium has been applied. First, I will refer to the draw-plate for drawing wire. There are at present, besides the iridium draw-plate, the ordinary steel plate which is used for drawing heavy wire, and the ruby plate, which is used in drawing gold and silver wires, where it is desirable to have them of uniform thickness. The iridium plate is made somewhat similar to the ruby plate, consisting of a piece of iridium which has been countersunk and drilled in the usual way to the size of the hole required, and set in a brass plate, where it is firmly held by a bushing. This plate is now coming into use, and is rapidly taking the place of the ruby plate, being equal to the ruby in hardness and much more durable, since it is less liable to break or chip by rough handling or heating.

Iridium knives are made for fine scales and balances, the bearing edge of which consists of iridium, soldered firmly to a brass body. These are rapidly taking the place of the agate for fine chemical balances, and there seems to be no reason why they should not have even a more extended use, since they are superior to the agate in that they take a finer edge and thereby make a more delicate balance, and are not so liable to crack or break. They are now being used altogether by Mr. Henry Troemner, of Philadelphia, the well-known scale manufacturer, for the purpose of adjusting his weights for all of his scales.

Hypodermic needles for physicians' and surgeons' use are now made of gold and tipped with iridium, in place of the old steel pointed ones, which are liable to rust or corrode if not properly taken care of. The iridium being hard will take a good edge, and is not subject to corrosion, as is steel.

Styluses for manifold writing are also being made with iridium points, having decided advantages over either steel or agate. Iridium points are also being applied to surveyors' and engineers' instruments, and in all places, in fact, where hardness, durability, and non-corrosibility are required For all the above uses the iridium alloyed by fusion with phosphorus is employed.

Some years ago experiments were made in order to apply this metal to the electric light. We found that an iridium electrode used upon the negative of an arc-light would keep its shape and resist the heat, provided the positive carbon which was used with it was not allowed to strike or fall too heavily upon the iridium negative. Since the metal at a white heat becomes malleable, a continual pounding or striking would gradually beat the negative out of shape. The iridium negatives are made by setting a piece of dephosphorized iridium in the end of a brass rod about six inches long and nine-sixteenths of an inch in diameter. The length of the iridium is about half an inch, ground conical in shape. It was found that the brass, being only half an inch from the arc, would resist the action of the heat; but in some cases where the lamp flamed the brass was liable to undergo partial fusion; and in such cases it was found desirable to put a thimble or cap of platinum over the end of the brass and just below the iridium, the platinum thimble being about half an inch long.

One of the most important applications of iridium which has yet been made is to the electrical contact-points of telegraphic apparatus. These contact-points consist of pieces of copper wire tipped with iridium, which are set in the instrument just as platinum points are set. These contacts will outlive many platinum contacts; are not subject to oxidization or sticking as are the platinum ones; and all that is necessary in order to clean them when they become dirty is to pass over their surface an emery file or a piece of fine emery paper. These contacts have been thoroughly tested by various eminent electricians and also by long-continued use, and the advantages herein stated have been in every case fully demonstrated.—*Wm. L. Dudley.*

Some Relations of Heat to Voltaic and Thermo-Electric Action of Metals in Electrolytes.*

By G. Gore, F. R. S., LL.D.

The experiments described in this paper throw considerable light on the real cause of the voltaic current. The results of them are contained in twenty tables; and by comparing them with each other, and also by means of additional experiments, the following general conclusions and chief facts were obtained.

When metals in liquids are heated, they are more frequently rendered positive than negative in the proportion of about 2.8 to 1.0; and while the proportion in weak solutions was about 2.29 to 1.0, in strong ones it was about 3.27 to 1.0, and this accords with their thermo-electric behavior as metals alone. The thermo-electric order of metals in liquids was, with nearly every solution, whether strong or weak, widely different from the thermo-electric order of the same metals alone. A conclusion previously arrived at was also confirmed, viz., that the liquids in which the hot metal was thermo-electro-positive in the largest proportion of cases were those containing highly electro-positive bases, such as the alkali metals. The thermo-electric effect of *gradually* heating a metal in a liquid was sometimes different from that of *suddenly* heating it, and was occasionally attended by a reversal of the current.

Degree of strength of liquid greatly affected the thermo-electric order of metals. Increase of strength usually and considerably increased the potential of metals thermo-electro-negative in liquids, and somewhat increased that of those positive in liquids.

The electric potentials of metals, thermo-electro-positive in weak liquids, was usually about 3.87 times, and in strong ones 1.87 times, as great as of those which were negative. The potential of the strongest thermo-electric couple, viz., that of aluminum in weak solution of sodic phosphate, was 0.66 volt for 100° F. difference of temperature, or about 100 times that of a bismuth and antimony couple.

Heating one of the metals, either the positive or negative, of a voltaic couple, usually increased their electric difference, making most metals more positive, and some more negative; while heating the second one also usually neutralized to a large extent the effect of heating the first one. The electrical effect of heating a voltaic couple is nearly wholly composed of the united effects of heating each of the two metals separately, but is not, however, exactly the same, because while in the former case the metals are dissimilar, and are heated to the same temperature, in the latter they are similar, but heated to different temperatures. Also, when heating a voltaic pair, the heat is applied to two metals, both of which are previously electro-polar by contact with each other as well as by contact with the liquid; but when heating one junction of a metal and liquid couple, the metal has not been previously rendered electro-polar by contact with a different one, and is therefore in a somewhat different state. When a voltaic combination, in which the positive metal is thermo-negative, and the negative one is thermo-positive, is heated, the electric potential of the couple diminishes, notwithstanding that the internal resistance is decreased.

Magnesium in particular, also zinc and cadmium, were greatly depressed in electromotive force in electrolytes by elevation of temperature. Reversals of position of two metals of a voltaic couple in the tension series by rise of temperature were chiefly due to one of the two metals increasing in electromotive force faster than the other, and in many cases to one metal increasing and the other decreasing in electromotive force, but only in a few cases was it a result of simultaneous but unequal diminution of potential of the two metals. With eighteen different voltaic couples, by rise of temperature from 60° to 160° F., the electromotive force in twelve cases was increased, and in six decreased, and the average proportions of increase for the eighteen instances was 0.10 volt for the 100° F. of elevation.

A great difference in chemical composition of the liquid was attended by a considerable change in the order of the volta-tension series, and the differences of such order in two similar liquids, such as solutions of hydric chloride and potassic chloride, were much greater than those produced in either of those liquids by a difference of 100° F. of temperature. Difference of strength of solution, like difference of composition or of temperature, altered the order of such series with nearly every liquid; and the amount of such alteration by an increase of four or five times in the strength of the liquid was rather less than that caused by a difference of 100° F. of temperature. While also a variation of strength of liquid caused only a moderate amount of change of order in the volta-tension series, it produced more than three times that amount of change in the thermo-electric tension series. The usual effect of increasing the strength of the liquid upon the volta-electromotive force was to considerably increase it, but its effect upon the thermo-electromotive force was to largely decrease it. The degree of potential of a metal and liquid thermo-couple was not always exactly the same at the same temperature during a rise as during a fall of temperature; this is analagous to the variations of melting and solidifying points of bodies under such conditions, and also to that of supersaturation of a liquid by a salt, and is probably due to some hindrance to change of molecular movement.

The rate of ordinary chemical corrosion of each metal varied in every different liquid; in each solution also it differed with every different metal. The most chemically positive metals were usually the most quickly corroded, and the corrosion of each metal was usually the fastest with the most acid solutions. The rate of corrosion at any given temperature was dependent both upon the nature of the metal and upon that of the liquid, and was limited by the most feebly active of the two, usually the electrolyte. The order of rate of corrosion of metals also differed in every different liquid. The more dissimilar the chemical characters of two liquids, the more diverse usually was the order of rapidity of corrosion of a series of metals in them. The order of rate of simple corrosion in any of the liquids examined differed from that of chemico-electric and still more from that of thermo-electric tension. Corrosion is not the cause of thermo-electric action of metals in liquids.

Out of fifty-eight cases of rise of temperature the rate of ordinary corrosion was increased in every instance except one, and that was only a feeble exception—the increase of corrosion from 60° to 160° F. with different metals was extremely variable, and was from 1.5 to 331.6 times. Whether a metal increased or decreased in the thermo-electromotive force by being heated, it increased in rapidity of corrosion. The proportions in which the most corroded metal was also the most thermo-electro-positive one was 65.57 per cent. in liquids at 60° F., and 69.12 in the same liquids at 160° F.; and the proportion in which it was the most chemico-electro-positive at 60 F. was 84 44 per cent., and at 160° F. 80.77 per cent. The proportion of cases therefore in which the most chemico-electro-negative metal was the most corroded one increased from 15.56 to 19.23 per cent. by a rise of temperature of 100° F. Comparison of these proportions shows that corrosion usually influenced in a greater degree chemico-electric rather than thermo-electric actions of metals in liquids. Not only was the relative number of cases in which the volta negative metal was the most corroded increased by rise of temperature, but also the average relative loss by corrosion of the negative to that of the positive one was increased from 3.11 to 6.32.

The explanation most consistent with all the various results and conclusions is a kinetic one: That metals and electrolytes are throughout their masses in a state of molecular vibration. That the molecules of those substances, being frictionless bodies in a frictionless medium, and their motion not being dissipated by conduction or radiation, continue incessantly in motion until some cause arises to prevent them. That each metal (or electrolyte), when unequally heated, has to a certain extent an unlike class of motions in its differently heated parts, and behaves in those parts somewhat like two metals (or electrolytes), and those unlike motions are enabled, through the intermediate conducting portion of the substance, to render those parts electro-polar. That every different metal and electrolyte has a different class of motions, and in consequence of this, they also, by contact alone with each other at the same temperature, become electro-polar. The molecular motion of each different substance also increases at a different rate by rise of temperature.

This theory is equally in agreement with the chemico-electric results. In accordance with it, when in the case of a metal and an electrolyte, the two classes of motions are sufficiently unlike, chemical corrosion of the metal by the liquid takes place, and the voltaic current originated by inherent molecular motion, under the condition of contact, is maintained by the portions of motion lost by the metal and liquid during the act of uniting together. Corrosion, therefore, is an effect of molecular motion, and is one of the modes by which that motion is converted into and produces electric current.

In accordance with this theory, if we take a thermo-electric pair consisting of a non-corrodible metal and an electrolyte (the two being already electro-polar by mutual contact), and heat one of their points of contact, the molecular motions of the heated end of each substance at the junction are altered; and as thermo-electric energy in such combinations usually increases by rise of temperature, the metal and liquid, each singly, usually becomes more electro-polar. In such a case the unequally heated metal behaves to some extent like two metals, and the unequally heated liquid like two liquids, and so the thermo-electric pair is like a feeble chemico-electric one of two metals in two liquids, but without corrosion of either metal. If the metal and liquid are each, when alone, thermo-electro-positive, and if, when in contact, the metal increases in positive condition faster than the liquid by being heated, the latter appears thermo-electro-negative, but if less rapidly than the liquid, the metal appears thermo-electro-negative.

As also the proportion of cases is small in which metals that are positive in the ordinary thermo-electric series of metals only become negative in the metal and liquid ones (viz., only 73 out of 286 in weak solutions, and 48 out of the same number in strong ones), we may conclude that the metals, more frequently than the liquids, have the greatest thermo-electric influence, and also that the relative largeness of the number of instances of thermo-electro-positive metals in the series of metals and liquids, as in the series of metals only, is partly a consequence of the circumstance that rise of temperature usually makes substances—metals in particular—electro-positive. These statements are also consistent with the view that the elementary substances lose a portion of their molecular activity when they unite to form acids or salts, and that electrolytes therefore have usually a less degree of molecular motion than the metals of which they are partly composed.

The current from a thermo-couple of metal and liquid, therefore, may be viewed as the united result of difference of molecular motion, first, of the two junctions, and second, of the two heated (or cooled) substances; and in all cases, both of thermo and chemico-electric action, the immediate true cause of the current is the original molecular vibrations of the substances, while contact is only a static permitting condition. Also that while in the case of thermo electric action the sustaining cause is molecular motion, supplied by an external source of heat, in the case of chemico-electric action it is the motion lost by the metal and liquid when chemically uniting together. The direction of the current in thermo-electric cases appears to depend upon which of the two substances composing a junction increases in molecular activity the fastest by rise of temperature, or decreases the more rapidly by cooling.

*Read before the Royal Society, Nov., 1883.

Undeveloped Sources of Power.

It is estimated that another century will witness the practical exhaustion of the coal supplies of the British Isles—that is to say, the mines will require to be carried to such great depths that the cost of producing this important agent of heat and power will be too great to make the mining of the material profitable. Before that time has arrived, therefore, unless meantime other deposits of natural fuel as yet overlooked are discovered—which, in view of the fact that the geology of the British Isles has been very carefully worked out, seems highly improbable. England will require to import her coal from abroad, as she now imports many other of the raw products which are utilized in her magnificently developed industries. The exhaustion, however, of her coal deposits is fraught with far more serious consequences than the exhaustion of her supplies of the multifarious raw products—cotton, wool, ores, etc., which enter directly into her factories, workshops, and furnaces—for obvious reasons; for without abundant and cheap supplies of fuel at her command at home, the mainspring which keeps in motion the complicated mechanism of her diversified industries is broken. As the source of motive power—the possession of abundant supplies of natural fuel—is, in the present state of civilization, absolutely necessary to the attainment of industrial independence, and, it may be truthfully affirmed, even of the maintenance of stable national existence.

For these reasons, the prophets of evil have made the approaching industrial and national decadence of Great Britain the theme of their doleful predictions. But they who venture such predictions fail to consider that long before such direful disaster it may come to pass that the resources of science will have brought about so profound a revolution in the methods of supplying motive power for the world's industries, that the possession of coal will have ceased to be the indispensible factor in the attainment of national greatness that it is in this day.

It is not only possible, but even probable, that the near future may witness a great advance in our methods of obtaining power from fuel. At present, as we have repeatedly pointed out, the margin for improvement in this direction is enormous, since, with even the best devices that modern engineering has been able to construct, we can only obtain about fifteen or twenty per cent. of the value of our fuels in the form of useful work. But this duty is being slowly, though surely, increased, and it is apparent that, should the duty of our steam motors be doubled or trebled, which is not an improbable circumstance, the life of our coal supplies will be considerably lengthened.

Other problems that are now attracting the attention of advanced thinkers, such as the conversion on a great scale of solid fuel into the form of fuel gas, as we pointed out in our last month's issue; the utilization of the incalculable supplies of water power existing in many localities, by its conversion first into electricity, in which form it may be transmitted over great distances with comparatively small loss, and distributed at will again in the form of mechanical energy; the utilization of the force of the tides, which affords a constant and inexhaustable source of power, which a little ingenuity, aided by the prod of necessity, could readily turn to useful account; the similar utilization of wind power and of the river currents; and possibly, also, the harnessing of the enormous energies of explosive compounds like gunpowder, nitro-glycerine, etc., to do the work of our engines. All these, and probably many more comparatively undeveloped sources of power, may within the next few decades so completely serve the purposes of the industries that the question of coal supplies will cease to be a leading one.—*Manufacturer and Builder.*

.... It is announced that the Mexican Telegraph Company will pay a dividend of 4 per cent.

Electrical Review.

Published Weekly at 23 Park Row.

P. O. BOX 3329.

GEO. WORTHINGTON, }
WM. A. HOVEY, } - - - Editors.
THOMAS H. DELANO, - - - - Publisher.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of Delano and Company, Proprietors. P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, JULY 12, 1884.

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Boston's committee on street lighting, working in the interest of the gas company, has removed the Weston electric light from Independence Square, South Boston. The result is that evil-disposed persons, who love darkness better than light, now congregate there, making it an unsafe place for respectable cit

A description is given in the *English Mechanic* of what appears to be a novel electric bell. The battery is contained in a cylinder of brass, inside which the line wire can be coiled by turning a little winch handle, and the gong is carried at one end of the brass case, serving as a cover for the magnet, etc. The case is provided with legs, so that the arrangement can be placed in a horizontal position, and there is also a ring, which enables it to be suspended wherever it may be desired. The outside dimensions of the whole apparatus are 6 inches by 4 inches.

At last we are getting at the facts concerning the Bridgeport electric light "accident," concerning which so much was recently said. A letter from a prominent manufacturer there says: "The facts were distorted in the published accounts *for a purpose*. Some boys, from 8 to 14 years old, threw a piece of telephone wire which they found over the electric light wire, and "waved" it back and forth until they cut completely through the insulation, and down to the base copper-wire. Until the current was sent over the line no damage resulted. After the current was on of course there was only one result—almost instant death. The coroner's jury exonerated the lighting company from all blame. It was such an accident as might happen if boys full of mischief and ignorant of danger played with a cartridge of dynamite until it exploded. Somebody gets hurt, with no one to blame but the boys.

No one can have failed to remark how prone inventors are to keep their inventions and discoveries in the experimental stage, and how averse they are to putting them to the test of actual commercial use on the ground that they are not ready. It is true that many an invention which, had it been properly perfected, might have proved a success, has been wrecked and ruined by premature putting on the market, but it is also true that it is futile to expect to absolutely perfect any important invention or discovery in the laboratory. No matter how carefully the work may be done, no matter how searching and trying the test, these, valuable and essential as they are, do not and cannot cover the test of actual practical use, and it takes just that test to discover what is lacking to make what is experimentally a success commercially valuable. Therefore we say that there is such a thing as waiting too long, and that it is a fatal error to suppose that an invention can jump without change or modification from the experimental to the commercial stage.

There is trouble in Stamford. According to a passage which we clip from the New York *Sun*, Mr. Frank J. Waterbury, local manager at Stamford, "received notice two weeks ago from the office of the Southern New England Telephone Company of a proposed increase of telephone rates from $35 and $40 to $40 and $45. Waterbury issued circulars containing a copy of the letter, and mailed them to subscribers. The business men at once ordered the company to remove the instruments on July 1. Officers of the company at once sent agents here, who said that the issuing of the order by Waterbury was a mistake and that no increase would be made. Waterbury was removed from his position. The business men, however, persisted in their action, and the subscribers disconnected their instruments themselves. There are forty-one of them." It seems incredible that Mr. Waterbury should have taken it upon himself to issue such a circular without instruction from his superiors, and equally incredible that such a circular could be out two weeks without its existence coming to the knowledge of the officers of the Southern New England Company in New Haven. If Mr. Waterbury *did* take it upon himself to issue such a circular, without instruction, his immediate dismissal was the only thing to be ordered. It looks very much, from the statement of the Company, giving present rates of rental there at that point, that the increased rate would be no more than a fair compensation for the service.

HOW TO DO IT.

It was claimed that the committee which for a long time had in hand the discovery of some method of putting all the wires underground was, in reality, seeking to find out how *not* to do it. While this was not the fact, and to assert it is to do injustice to very many worthy men, it must be admitted that, considering the length of time the matter was in the committee's hands—and we believe that it has not yet passed out of their hands—very little was accomplished, and that there was an altogether unnecessary delay in giving to the public the altogether harmless and inoffensive "report" which represented the conclusions of the sub-committee. The fact is that the general committee was altogether too big, that its members took little or no interest in the question with which they had to deal, and that the whole matter was left to two or three people to handle. The result, thus far, has been a report which amounts to nothing, and which contains but one suggestion of any value whatever, viz.: the suggestion that a commission of experts, suitably paid and provided with the means for determining facts by actual experiment, be appointed by the State of New York to investigate the whole subject. The suggestion that such a commission take "the work up where the General Committee left it" we do not like, for the reason that the General Committee left it *nowhere*. The thing for such a commission to do is to begin at the beginning, to take absolutely nothing for granted, and to pay no more attention to the fine-spun theories of the report submitted to the General Committee than to the wind that blows. A commission of men of expert knowledge, combined with common sense, that will begin as though nothing had been done, have no pet schemes or "systems" to promote, and work solely with a view to determining what can and what cannot be done, is sure to reach some conclusions of value. But if it should set about its work as did the General Committee, scattering itself all over the field and really doing nothing, it would land just as the General Committee did—nowhere.

TELEGRAPH COMPETITION.

It may safely be assumed, although all the details have not yet been agreed upon, that the telegraph companies of this country are to be substantially reduced to two, the Western Union on the one side, and a combination of the Postal, Bankers and Merchants', and the Baltimore and Ohio on the other. Just what form the latter combination will take, whether it will be brought about by pooling, by absorption, or by a union under an entirely new name, does not appear, nor is it, so far as the public is concerned, essential. The important fact is that Western Union seems likely, at last, to have a competitor worthy of its steel, a competitor that comes to stay, and that is not put into the field for the sake of being sold out. We believe that it is best for the public interest, and best, too, for telegraphic interest, that there should be such competition, and that it should be permanent. It cannot but result in a great increase in telegraphic facilities, and in the fixing of rates at figures which will tend to very greatly increase business. It is wonderful how cheaply telegraphing can be done if there be but enough of it to do, and this competition, and the increase of facilities which it occasions, is sure to result in an increase in the use of the wires far greater than has been seen in the past. The fact is that this country is only fairly *beginning* to use the telegraph. While it is true that business men use it very largely, it must be remembered that among the great mass of the people it is resorted to only in emergencies, and that in more than half of the families in this country the sending or receiving of a telegram is an event of so much importance that the sight of a messenger boy at the door, message in hand, is cause of anxiety and fear lest some terrible calamity has befallen. All this is to change. The telegraph, still further cheapened, with offices within easy reach of every one, is, in the not distant future, to be as familiar and useful a servant to the public generally as it now is to the banker, broker, merchant, and politician, and the number of messages sent in a year is to be doubled, and quadrupled, and doubled again within a very few years. It is because we see that the business is to attain these stupendous proportions that we believe competition and a division to be desirable; and, we ought to add, it is because we feel certain this competition is to exist that we are assured that the business will assume the vast proportions which we have ventured to predict.

If it be asked how this is going to affect the value of Western Union, which has had, to a very great extent, a virtual monopoly of the business, we reply that, in our opinion, the effect, if any there be, will be favorable. Why? Because the increased facilities and the rates that will be made will induce an immense increase in the total volume of business, and of this increase the Western Union is sure to get by far the larger proportion. Moreover, Western Union can transact its business cheaper than any new competitor coming into the field, and is in possession of contracts and franchises which give it decided advantages. A big competing company, well arranged, can get enough of the business to make money for its stockholders and *keep Western Union in order*, but it cannot and will not destroy the value of Western Union, nor is it desirable that it should. It is all very well to say that Western Union is "half water." In the present state of the market it looks as though a good bit of the "water" had been wrung out. But the fact remains, and it is an important and interesting one, that the company is easily earning seven per cent. per annum upon its entire stock, water and all, and no one who knows the facts in the case doubts that it can, with or without competition, continue to earn this, and more. The Western Union Company is like a well-established newspaper. Attacks from without can never injure it. Nothing but internal mismanagement, intentional or through ignorance, can break it down. This is an ever-present danger.

"ELECTRICAL" GIRLS.

Among the products of the South which are just now receiving prominent mention in the daily press is the so-called "electrical girl," of which there seem to be a large and increasing crop. The peculiarity of this human phenomenon, of which Georgia just now appears to be the chief source of supply, is that when she touches a table, chair, billiard cue, umbrella, or other piece of inanimate though movable property, it is immediately set in motion in the most fantastic and unaccountable manner, and this, too, despite the most serious efforts of stalwart men of unquestioned veracity and integrity to keep it in place. Cases have been known when two men have seated themselves in the same chair, one reposing upon the lap of another, the two apparently solidly and substantially seated, their combined weight exceeding four hundred pounds. Now comes the "electrical girl," a slight maiden of sixteen summers, who places the tips of her finely-tapered fingers upon the back of the chair. In an instant it is switched from beneath the occupants, who are unceremoniously landed upon the floor, while the chair spins around on one leg like a top.

Again the "electrical" girl holds at arms length an ordinary billiard cue. She wields it gracefully and easily, and holds it so lightly that it seems as though a child might wrest it from her frail grasp. But strong men, with brawny arms and mighty muscle, sieze it and do their best to possess themselves of it. All in vain. One after another they retire from the effort, discomfited and disheartened, and the cue remains in the fair, frail hands of the "electrical" girl. Next, an umbrella is produced, and a young man in the audience is invited to come upon the stage and hold it over the head of the maiden. All goes well until he opens it. Then the trouble begins. It begins to sway gently from side to side. The youth holds on with both hands, but the umbrella is too much for him It literally pulls him about the stage, gently at first, afterwards with decided and increasing violence, until, worn out and discouraged, he relaxes his hold, whereupon the "demonstration" ceases. And so on, to the end of the chapter, the "electrical" girl manifests her power and her contempt for the ordinary laws and forces of nature.

It may be asked why we make mention of these facts which concern, just now, the show business. It is to enter a protest. It is to ask a question. Why should this phenominal maiden be called "electrical?" What proof has she ever given of electricity? Does her presence disturb a galvanometer? Is she capable of producing a spark? Do those who take her hands receive a shock? Or is it because of the things which she does that she is called "electrical?" If so, why? What man, possessing a store of electricity, whether in a primary or secondary battery, whether in a dynamo or magneto, can, therewith, cause tables to dance, chairs to empty themselves of their occupants, or umbrellas to pull strong men around an apartment? What has it to do with electricity, anyway, any more than with steam?

We welcome this new product of the South as interesting and phenomenal. We trust that it may be numerous and pecuniarily successful. We hope to see it astonish and astound unnumbered thousands, and feel well convinced that those who see it will receive the full worth of their money. But we protest against the descriptive cognomen assumed as being incorrect in itself and un-

just to electricity, whose most ardent advocates claim for it no such powers as the maidens in question appear to possess. Electricity is, in all conscience, sufficiently erratic and mysterious as a force, but let us be just to it, and see that it is not charged with doings with which it has no possible connection. "Magnetic men," as a description which has nothing whatever to do with magnetism, is bad enough, but when it comes to calling these young ladies from the sunny South "electrical." that is going a step too far.

The Italian General Exposition.

INTERNATIONAL EXHIBITION OF ELECTRICITY.

The electrical exhibition opened lately in Turin embraces some considerable and important productions of this physical branch, which several exhibitors of various nationalities present to the intelligent visitor, who admires its application to the divers branches of industry and public use.

In our rapid visit to this section, we will point out the more recent discoveries, and make particular mention of the most conspicuous ones, which are fruits of the genius and practical observations of the patient scientists who effected improvements in the first systems, and introduced new ones.

The use of electric currents for the transmission of force, of the galvanic machine, and, above all, of the process for the propagation of light, had a powerful incentive to generalize itself in 1881 at the International Exposition of Paris. There were many exhibitors who merited particular distinction, among whom I remember, at present, Lignor Burgin, who received at that exhibition a gold medal. This eminent scientist, among others of his fine inventions, showed a dynamo machine with special electric generator of easy and certain manipulation. This machine figures in the exposition at Turin, carried to a higher degree of perfection by Messrs. Elliott & Co., which they exhibit at the same time with a number of different kinds of lamps with fixed flames, which give regular and constant light by means of a regulator of their own invention.

Several types of these lamps have been for some time in use at hotels, offices, and several other establishments.

Among the several exhibits of Messrs. Elliott & Co. may be seen a dynamo machine (Burgin system) for the purpose of firing mines, which has already been adopted by the federal army of Switzerland.

The firm of Ganz & Co., of Buda-Besth, renowned for its manufactures of machines, which supply work for about 4,000 workmen (as also for its electrical establishment), sends to the exposition as the exhibit of its electrical works, (Zipernowsky system) a new machine, which works automatically, with a special motor for the transmission of the electrical current, and can extend regularly and clearly its light to the distance of about 10 miles (15 kilometers). This machine is most valuable, not only for its simplicity, which renders it extremely easy to manage, but also for the perfect reliability it displays. It serves besides to light no less than 500 lamps.

The Eastern Telegraph Company merits also a prominent place for its splendid exhibit of the Thompson apparatus for the transmission of telegraphic dispatch esacross long submarine passages. The utility of this invention is too well known for us to waste words to describe it. We therefore limit ourselves to saying that it has reached almost the highest degree of perfection.

Among the productions of this special section we will take a bird's flight, so to speak, and, not to prolong this article unnecessarily, we will only mention the following:

The new printing telegraph apparatus with automatic transmission, of Sig. Lucchesini of Pisa.

The reometrical machine of the highest possible deviation, of Prof. G. Basso.

The magnetic spectrum traversed longitudinally with currents of electricity in iron or copper spirals, or with both simultaneously of Admiral Ricco.

The gas motors (Otto system) from one-half to sixty horse-power, of Laugez & Wolf, of Vienna.

A deposit of electrico-galvanic tissues, which have already been patented in France and elsewhere, of MM. Bevot, and Velle of Lyons.

The contrivances for electrical transmission, and the regulator, of Spielker & Co., of Cologne.

The machines with a second generator, of Gaulard & Gibbs, of Paris, for the transmission of force to great distances.

The metallic targets with electric signals, of Col. Bregoli and Capt. Ceroni.

The enormous motor of 220 horse-power from the firm of Nerville of Venice, which can compete with the best foreign productions of its kind.

Moreover very beautiful and admirable are the so-called rooms, to the number of twelve, illuminated entirely by the Cruto Company, by the Edisonian General Society and by Nigra of Turin.

These rooms, which are furnished artistically, carpeted richly, hung with paintings, and filled with nick-nacks, and various other *articles de luxe* of every kind, form a complete suite of apartments, which seen brightly irradiated by the fullest electric light, present a powerfully striking and brilliant effect.

But how much more beautiful, even than the apartments, is a charming little winter garden, dazzlingly white and snowy, ornamented by a graceful foaming cascade, arbors hung with icicles, statues of white marble, little ornamental trees with airy designs in ice on their branches; this fairy garden is entirely flooded by the soft white electric light, which is emitted by little jets; one would imagine it was no artificial light, but the exquisite radiance of an Italian moonlight, so romantic, and refulgent is this snow-white splendor.

We should not close this our brief account of the electrical wonders without remarking that in front of the three chambers occupied by the Edisonian General Society, there stands the pavilion of Sig. Nigra, who has there collected telephones, electric clocks and watches, and electrical machinery of every kind.

The same celebrated exhibitor has, moreover, a room for telephonic communication.

The School of Physics and Chemistry of Paris.

Recently we paid a visit to the New Municipal School of Physics and Chemistry that the City of Paris founded in 1882, and that is now in operation in the large building of the old Rollin College. This establishment is one of those that supply a long felt want of our time, and we are happy to make it known to our readers. The object for which it was designed was, in the intention of its founders, to give young people who have just graduated from the higher primary schools special instruction which shall be at once scientific and practical, and which shall fit them to become engineers or superintendents in laboratories connected with chemical and physical industries. To reach such a result it has been necessary to give the teaching an essentially practical character, by permitting the pupils to proceed of themselves in manipulations in well-fitted laboratories. It is upon this important point that we shall now more particularly dwell; but, before making known the general mode of teaching, we wish to quote a few passages from the school's official programme:

"Many questions and problems in physics, as well as in chemistry, find their solution only with the aid of mathematics and mechanics. It therefore became necessary, through lectures bearing upon the useful branches of mathematics, to supplement the too limited ideas that pupils brought with them on entering the school. Mathematics and mechanics are therefore taught here at the same time with physics and chemistry, but they are merely regarded in the light of auxiliaries to the latter.

"The studies extend over three years. Each of the three divisions (first, second and third years) includes thirty pupils.

"During the three first semesters, pupils of the same grade attend lectures and go through manipulations in chemistry, physics, mathematics and draughting in common.

"At the end of the third semester they are divided into ten physical and twenty chemical students.

"From this moment, although certain courses still remain wholly or partially common to the two categories of pupils (physical and chemical), the same is no longer the case with regard to the practical exercises, for the physical students thereafter manipulate only in the physical laboratories, and the chemical only in the chemical laboratories; moreover, the manipulations acquire a greater importance through the time that is devoted to them.

"At each promotion the first three semesters are taken up with general and scientific studies. Technical applications are the subject of the lectures and exercises of the three last semesters. At the end of the third year certificates are given to those pupils who have undergone examination in a satisfactory manner, and diplomas to such as have particularly distinguished themselves."

When pupils have been received at the school, after passing the necessary examination, their time of working is divided up between lectures and questionings and different laboratory manipulations.

The course of lectures on general and applied physics comprises hydrostatics and heat (Prof. Dommer), electricity and magnetism (Prof Hospitalier), and optics and acoustics (Prof. Baille). Lectures on general chemistry are delivered by Profs. Schultzenberg r and Henninger, on analytical chemistry by Prof. Silva, on chemistry applied to the industries by Prof. Henninger (for inorganic) and Prof. Schultzenberger (for organic). The lectures on pure and applied mathematics and mechanics are delivered by Profs. Levy and Roze.

The pupils occupy themselves regularly every day, during half the time spent at the school, with practical work in analytical and applied chemistry and physics and general chemistry. This practical work is a complement to the various lectures, and has reference to what has been taught therein. Once or twice per week the pupils spend three hours in a shop devoted to wood and metal-working, and learn how to turn, forge, file, adjust, etc.

The school's cabinets are now provided with the best instruments for study, and are daily becoming richer therein. The chemical laboratories are none the less remarkably organized. Each pupil has his own place in front of a large table, provided with a stand, whereon he may arrange all the products that he has to employ. Beneath the work-table he has at his disposal a closet in which to place his apparatus after he is through using them. Each pupil has in front of him a water faucet, which is fixed to a vertical column and placed over a sink. Alongside of this faucet there is a double gas-burner, which may be connected with furnaces and heating apparatus by means of rubber tubing. A special hall, with draught and ventilation, is set apart for precipitations by sulphureted hydrogen and the preparation of chlorine and other ill-smelling and deleterious gases. The great amount of light and space provided secure the best of conditions of hygiene to this fine and vast laboratory, where young people have all the necessary requisites for becoming true chemists.—*La Nature.*

Electricity on the Ocean.

That the electric light on board ship is a public benefit is universally admitted. An excellent light, eclipsing all others in brilliancy and purity, it is devoid of heat. These qualities alone are sufficient to make it invaluable to all who make a sea voyage. "It is a fallacy to imagine that there is any danger in regard to the wires used in connection with the electric light," said the engineer of an ocean racer. I am constantly handling the wires, and do so when the electricity is at its highest pitch, without any fear. In touching the wires a slight shock is felt. Passengers sometimes apply to be allowed to touch the wires when suffering from rheumatism, etc. There is no danger from fire, for if the globe breaks and the light be exposed to the oxygen in the air it goes out immediately.

The light is perfectly harmless, Mr. Edison says. "There is no danger from contact with the wires or from fire. An accident from either of these causes is impossible. The current of the light is what is called a slow current. Contact with a wire connected to the arc light would be fatal, but with the incandescent harmless."

The Inman ship City of Berlin was some few years ago the pioneer of electric lighting on board ship, but now its use is almost universal, and with such completeness as to extend from the main saloon even to the stoke holes. Among the ocean steamships on which the electric light is used are the America, Austral, Asiatic, Arizona, Auronia, City of Rome, City of Chicago, City of Berlin, Germanic, Normandie, Servia and Weymissia, and in every case the highest satisfaction is the result of its use.

Steam Engine Economy.

Editor Electrical Review:

It has been stated by one of our most noted electricians "that the coming electric light engine has not yet been evolved."

Believing that I have apprehended some defects in present steam engine practice, I desire to place them before your readers, thinking that possibly some light may be obtained thereby.

To handle steam economically in connection with engines, it should work expansively in large measure—*i. e.*, enter the cylinder through large ports, and thus obtain as near boiler pressure as possible up to point of cut-off, and allow it to expand down to a trifle above atmospheric pressure at point of exhaust.

Now, during the period of steam-taking and expansion to point of exhaust is the *whole time* during which the work can be obtained from the steam. If, therefore, by *any means*, or for *any reason*, this *time* be shortened, a serious loss will evidently occur, and the engine can give but imperfect results.

Given an engine of the most perfect construction, with the fly-wheel on the engine shaft of usual size and weight, and it will be found in operation that the piston moves faster during the time of taking steam and expansion, than it does during the period of exhaust and passing the dead center. In thus moving faster during time of steam-taking and expansion, it also shortens the time in which the steam can work in exact ratio, as the time is lengthened during exhaust and passing the dead center. In other words, the time and speed lost at the dead centers must be made up again during the time the piston receives its power. Were it not done the engine would soon cease moving. It is thus plainly shown that the time in which the steam can work is shortened. To overcome these defects it appears necessary to carry in connection with the engine itself a greater potential or live power, to prevent check of speed, and not lose temporarily at each half-stroke a portion of the potential or live power gained, and necessary to have remain constant. Under the laws and conditions that the steam engine operates, these constantly recurring checks to its movements, and consequent falls in its acquired potential, when due to causes within the engine itself, are a total loss. Extra energy is demanded at each succeeding half-stroke of the piston to supply this loss alone.

It is evident no speed has been gained or extra work performed by calling out this extra power, consequently the power so called out would not have been required had not the fall in potential occurred. The conclusion must follow that the check produces a loss in exact ratio to the square of the velocity and mass checked.

I will endeavor to show in a future article how these difficulties may be overcome by direct and simple methods, and thus obtain greater efficiency for the steam engine.

I would be pleased to hear from others on this important subject.

JOHN R. MARKLE.

Detroit, Mich., July 3d, 1884.

Telephonic News

⁂ Acording to the *Industriel Elbeuvien*, a telephone system is to be established at Elbeuf, which is in the first instance to be connected with Rouen and Havre, and then with Paris. The work will be proceeded with as soon as the concession is granted and the agreements between the town and the Government are signed.

⁂ Representatives of several telegraph, telephone and electric light companies had a conference with Mayor Low, in Brooklyn, on Thursday last. The impossibility of putting the wires underground, and of complying with the recent law passed on the subject, was urged. After the conference, Mayor Low said he was not able to see any way to literally comply with the law, even though the question of expense were left out altogether.

⁂ General Manager Howard says the Tropical Telephone Company has just received its first remittance from the Barbadoes exchange—a check for $400 gold, the net profits for May, and the agent writes that he expects to remit regularly hereafter, as the receipts will now exceed expenses and construction by that amount monthly. Reports from Caracas show that the receipts at that point now exceed expenses and construction by $1,200 per month. This property is under control of the Intercontinental Company.

⁂ The general manager of the Intercontinental Telephone Company says they have continued good reports from Caracas and La Guayra. The present number of subscribers connected is 327, at $5 per month, and 19 applications await connection. The trunk line business still increases, reaching 1,319 messages in May, equal to $843.80, at 20 cents each. The agent expects fully $1,000 per month from this source, as soon as additional wires are run, as at present the wires are taxed constantly with business. The new Government is equally friendly to the enterprise with Gusman Blanquo's, and merchants are expressing a wish to acquire an interest in the business. The company is sending out iron poles and ærial cables to accommodate additional wires from central offices.

⁂ An instance of the jealousy with which everything done in Manchester is watched by some people in Liverpool, says a correspondent, is afforded in the matter of telephonic communication. Manchester and Salford being divided by only a narrow stream, have, as a matter of course, been associated by means of the telephone, as they have been by so many other agencies. Liverpool is divided from Birkenhead by a river three-quarters of a mile wide, and, because the postal authorities have refused to sanction the application of the Lancashire and Cheshire Telephonic Company to establish communication between the two places, it is suggested that an undue preference has been given to Manchester. To unprejudiced minds the analogy will appear rather ridiculous. Telephonic communication between Manchester and Salford presented no difficulty whatever, but to cross the Mersey is a very different matter. The completion of the river tunnel may have proved an easy solution of the question, but it is obviously one which ought to be decided upon its own merits without any reference to Manchester and Salford, and the spirit evinced when such a comparison is instituted is hardly creditable to the great Mersey port.

⁂ At one end of the public reading-room where I occasionally resort, says a Boston letter-writer, is a small inclosure containing a telephone; and sitting in my accustomed corner I am often interested in speculating upon the nature of the messages that are shouted into the telephonic ear. As, for example: A rather fine-looking man in evening dress has just petitioned "central" that he may connect with the private telephone in his own up-town residence. The connection duly made, a conversation something like this follows:

"Is that you, Augusta Jane?"

It probably is, for in a moment or two the communicant calls again.

"Yes, dear—you needn't wait supper—I sha'n't be home—got to meet a fellow here on business."

("Hello?")

"I can't come, I tell you—important business—got to look over some papers with Mr. Smith."

("Hello?")

"Don't know what time—uncertain—will come as soon as I can."

("Hello?")

(Loses his grip on his patience—presumably from reply of Augusta Jane.) "Look here—I'm going to stop here, if I'm not home for a week—business is business, you hear me—that's all; ta, ta!" and thus the conversation closes.

Then, with a somewhat flushed face, the speaker emerges into the reading-room, with a facetious wink at another gentleman, whom I at once imagine is Smith, who suggests the advisability of "taking something"—probably a walk—as they both trip gayly away in the direction of the "wine room," which is a Boston euphemism for the hotel bar.

⁂ The *Bulletin de la Compagnie Internationale des Telephones* publishes very satisfactory statistics of the Netherlands Bell Telephone Co. of Holland. On the 1st of May the latter company had the following number of subscribers:

Amsterdam—1,093 subscribers, of which 1,059 connected.

Rotterdam—508 subscribers, of which 502 connected.

Arhnem—127 subscribers, of which 123 connected.

's-Gravenhage—190 subscribers, of which 174 connected.

Groningen—72 subscribers, of which 68 connected.

Utrecht—68 subscribers, of which 66 connected.

Haarlem—97 subscribers, of which 66 connected.

Zaandam—114 subscribers, of which 66 connected.

Dordrecht—78 subscribers, of which 66 connected.

Total—2,187 subscribers, of which 1,992 connected. The increase in three months is 134 subscribers.

Telephony and Telegraphy on the Same Wires Simultaneously.

For the last eighteen months a system has been in active operation in Belgium whereby the ordinary telegraph wires are used to convey telephonic communications at the same time that they are being employed in their ordinary work of transmitting telegraphic messages. This system, which we have alluded to several times before, is the invention of M. Van Rysselberghe, whose previous devices for diminishing the evil effects of induction in the telephone service will be remembered, has lately been described in the *Journal Telegraphique*, of Berne, by M. J. Banneux, of the Belgian Telegraph Department. Our information is derived from this article and from others by M. Hospitalier.

The method previously adopted by Van Rysselberghe, to prevent induction from taking place between the telegraph wires and those running parallel to them used for telephone work, was briefly as follows: The system of sending the dots and dashes of the code—usually done by depressing and raising a key which suddenly turns on the current and then suddenly turns it off—was modified so that the current should rise gradually and fall gradually in its strength by the introduction of suitable resistances. These were introduced into the circuit at the moment of closing or opening by a simple automatic arrangement worked exactly as before by a key. The result of the gradual opening and gradual closing of the circuit was that the current attained its full strength gradually instead of suddenly, and died away also gradually. And as induction from one wire to another depends, not on the strength of the current, but on the rate at which the strength changes, this very simple modification had the effect of suppressing induction. Later Van Rysselberghe changed these arrangements for the still simpler device of introducing permanently into the circuit either condensers or else electro-magnets having a high coefficient of self-induction. These, as is well known to all telegraphic engineers, retard the rise or fall of an electric current; they fulfill the conditions required for the working of Van Rysselberghe's method better than any other device.

Having got thus far in his devices for destroying induction from one line to another, Van Rysselberghe saw that, as an immediate consequence, it might be concluded that, if the telegraph currents were thus modified and graduated so that they produced no induction in a neighboring telephone line, they would produce no sound in the telephone if that instrument were itself joined up in the telegraph line. And such was found to be the case. Why this is so will be more readily comprehended if it be remembered that a telephone is sensitive to the changes in the strength of the current if those changes occur with a frequency of some hundreds, or in some cases thousands, of times *per second*. On the other hand, currents vibrating with such rapidity as this are utterly incompetent to affect the moving parts of telegraphic instruments, which cannot at the most be worked so as to give more than 200 to 800 separate signals *per minute*.

The British and Foreign Telephone Company, Limited.

We have received a circular to the effect that the British and Foreign Telephone Company, Limited, is prepared to supply telephone transmitters and telephone receivers, made under Boult's patent, No. 3,271 A. D. 1883, free from infringement of any other patent. The telephone receiver is an improvement on the "Glasgow" receiver, and, like it, has a metallic disc *tilted up*, and not "held down all round its edge." The current regulator of the transmitter is an entirely new form of Hughes's carbon pencil microphone, the improvement consisting in dispensing with a diaphragm and tympan, and in placing a turbine wheel on the carbon pencil. Mr. Justice Fry decided, states the circular, that "the true meaning of the claim in Edison's patent is the union of a tympan or diaphragm capable of vibrating under sound waves, with a tension regulator, and that Edison described the essential requisite of his invention to be the combination of a vibrating diaphragm and a tension regulator." Boult's current regulator has no diaphragm or tympan, or any equivalent thereof, and, therefore, is entirely free from Edison's, Blake's, or any other patent. Mr. G. W. Hemming, Q. C., gives as his opinion that "the 'Boult' transmitter is not an infringement of the 'Edison' transmitter patents," and also that on the construction which has been judicially put upon the "Bell" patent the "Boult" receiver is not an infringement.—*London Electrical Review.*

Women as Telephonists.

Three years ago the United Telephone Company began to employ women. "Chiefly for reasons of economy," we learn, but besides this there are other advantages. If a boy 14 years old is employed as a telephonist his voice will before long become hoarse and indistinct; with a girl this is not the case. The female voice is always clearer, and as a clear voice (besides a good ear) is one of the chief requirements of a telephonist, women are naturally preferred. They are admitted at the age of 16, the majority of those at present employed by the United Telephone Company being between the ages of 16 and 22. From the number of two, with whom the experiment was begun, they have risen to over a hundred, who perform their duties to the satisfaction of the company. Preference is given to the daughters of professional men; this, however, is no strict rule. There are no preliminary examinations to be passed before admittance into the telephone office. The different ranks are the clerk in charge, who has the supervision of a room in which are employed from six to fifteen clerks; the deputy of the clerk in charge, the first and second-class operator, and the learner. According to these ranks the payment varies, as a rule, however, 11s. to 16s. is the weekly pay, which sometimes rises to £1, and in rare cases to 25s. The hours of work are from 9 till 6 or 10 till 7, respectively. No case of illness has occurred on the staff since the commencement of the work; the general state of health is also satisfactory, and Mrs. Merlin, the lady superintendent to the whole staff, is of opinion that the girls are on an average well satisfied with their situation and fond of the work. It is, perhaps, a disadvantage that the girls have to talk all day long; but this very fact is said to prevent them from indulging in disputes and gossip, and makes their work comparatively quiet—a point upon which some subscribers to the exchange have been known to entertain a different opinion. The aspect of a telephone office is curious enough to an outsider. A number of young girls sitting before a cupboard-like structure into the apertures of which they are busily chattering, holding in the meanwhile an instrument like an ear-trumpet to their heads, would appear ridiculous enough were it not well known how indispensable the telephone has become to civilization.—*Pall Mall Gazette.*

Provincial Opinion on the Telephone Question in England.

In an article dealing with the attitude of the postal authorities towards telephone development, the Leeds *Mercury* states: "Mr. Fawcett, as Postmaster-General, finds himself in the position of having to defend, in respect to the use of telephones, a monopoly which, as a political economist, it may be taken for granted he would strongly denounce. By the purely technical construction of an Act of Parliament, the Post-Office succeeded in its claim to a monopoly of all telegraphic communication, including the telephone, though the latter was not invented until after the act was passed. Having established its claim in this respect, it has, without maintaining the exclusive right to provide the means of communication, checked the development of the telephone by restrictions of the most onerous kind. In effect, it has prevented the utilization of the telephone on lower terms than those charged for the use of the telegraph. There are restrictive conditions as regards intercommunication between different counties, and even between different towns; and companies taking out licenses from the Post-Office are debarred from transmitting occasional messages at lower than telegraph rates. The result has been a limitation of the telephone in this country, which has no parallel either in Europe or America. There is no doubt that if the restrictions as to the intercommunication between different places and upon occasional messages were removed, the telephone would soon become as popular in England as it is in Germany, France and the United States. It has, for instance, been proposed to establish offices of call, and to make a charge, say, of 1d. per message. The Postmaster, however, refuses to sanction any lower charge than 1s. per message, which would be virtually prohibitive. The restriction operates, in fact, as a prohibition. We cannot but think this is a mistake, even as a matter of policy. Either the Post-Office should undertake absolutely, as it has done with the telegraph, the providing a public telephonic service, or it should issue its licenses on the most liberal conditions, leaving the companies to work the system in whatever way they might think best, recouping themselves by such charges as they deemed sufficient. The present policy is a sort of dog-in-the-manger policy. The Post-Office will neither do the thing properly itself nor let anybody else do it. We may be sure that Mr. Fawcett has yielded a very unwilling adhesion to the system he is responsible for administering. We trust the time is not distant when he will see his way

to put an end to this monopoly by issuing practically unconditional licenses."

The Manchester *Courier* points out that, with praiseworthy zeal to meet a public requirement, the Telephone Company have sought permission of the postal authorities to provide trunk wires between Manchester and the surrounding towns, and to open offices at which those of the public who are not subscribers should be able, by a small payment, to communicate with any subscriber on the system. These extensions of the usefulness of the telephone have been steadily resisted by the Post-Office. The Post Office have a monopoly of the telegraphic system of communication, but is that any reason why they should prevent the development of a system of which they are not the owners? If the postal authorities find that the newer system of communication is likely to supersede that which belongs to them, their better plan will be, not to interfere with it in such a way as to curtail the public convenience, but to make such an arrangement as will promote it, either by absorbing the telephonic companies, or by adopting the principle of free trade in the matter.

The Manchester *Evening Mail* thus deals with the question: "Practical-minded English people have recognized the fact that facilities for rapid communication are one of the absolute necessities of the age, and it is owing to no lack of enterprise on their part, to no reluctance of theirs to avail themselves of recent discoveries in electric science, if we are still behind other nations. The fault rather lies in a state of things which has crippled private enterprise and retarded progress by keeping up the Post-Office monopoly. The Post-Office is to the telephone companies what the Old Man of the Sea was to Sinbad the Sailor, the principal difference being that, whilst Sinbad did get rid of his unwelcome burden, there is little or no prospect of relief for the telephone companies, who find themselves driven to the resource of appealing to public opinion for its verdict on the matters at issue." Having reviewed the litigation which has taken place, the *Mail* continues: "It is not surprising that in this state of things the telephone companies do not find their hands so free for the extension of their business as they would desire. The excellent idea of establishing 'call offices' has, further, proved wholly impracticable in this country owing to the opposition of the Post-Office. * * * It may be in the recollection of some Manchester people that about two years ago a 'call office' was established on the Manchester Exchange for the use of the members. It was kept open for about six months, but it proved a failure, for the sufficient reason that the Post-Office required that a charge of one shilling should be made, the Post-Office itself pocketing half the sum. * * * An impartial consideration leads to the conclusion that there is a deliberate attempt on the part of the Post-Office to impede the development of the telephone business, as far as possible, in the interests of the telegraph. The Post-Office is proving simply a gigantic obstructive. It possesses a monopoly, and is evidently determined to protect it, no matter to what extent public convenience may suffer. An honest intention to allow the telephone fair play would have led to far different treatment of the telephone companies than that which has been shown to them. The effect of so-called 'concessions' would not have been spoilt by the imposition of prohibitive charges, by wholly impracticable regulations, and by the lack of anything approaching dispatch in the transaction of business. It is thus easy enough to see why the use of the telephone has not been developed in this country to the same extent as in America and on the Continent. The public ought to decide the question whether the systematic obstruction of one of the most useful of modern inventions should be tolerated any further, more especially in view of the probability that the telephone will affect the telegraph to a far less extent than the fears of the postal authorities lead them to suppose. If the purchase of the telegraphs by the Post-Office did not prove so good an investment as was expected, that is no adequate reason for establishing a system of 'protection' towards the postal telegraphs, and for retarding in every possible way the development of the telephone, which has already proved of such immense benefit. It is the public interests, and not the Post-Office revenue, that deserve first consideration."

The Brockton Combination Line Vise.

This simple yet effective instrument supplies a want long felt in telegraph line construction and repairs, and doubly apparent since the advent of the telephone exchange.

The wire stretcher is applied in an instant, even on the highest structure, at the extreme length of the lineman's arms; and by the spring of the eccentric effectually clamps the wire, and tightens its grip with every pound of power applied, loosing its hold as quickly when the strain is removed and the eccentric raised by the thumb. It is thus far preferable, for repair work, to the ordinary hand vise, which must often be screwed to its place by the line pliers at an imminent danger of life or limb.

It will grasp any size of wire from 8 to 20; is found by the most severe tests to be uniformly reliable and quick in its work, and never injures the wire, while a flange prevents the wire from twisting out, even when thrown in spirals from the coil. Each instrument is tested by a drawing strain of 500 pounds, and in line construction may be used, without hesitation, in tightening four or five stretches of No. 9 wire at once by the aid of ropes and pulleys. The tool has been

heretofore made of cast steel, neatly japanned with forged steel eccentric. It is now proposed to have the whole drop forged, which will insure greater durability in the hands of inexperienced or careless linemen.

The splicing vise attachment is strong and durable, and quite as effective for this purpose as the best vises in common use. Few linemen will return to the ordinary tool after a week's fair trial of the combination line vise.

This vise was called into existence by the necessities of the early days of telephone work, in 1878, by W. J. Jenks, of Brockton, Mass., who built some of the first lines in New England during that year, and continued its use in the exchange afterward organized there, of which he was for some years manager. It was patented in March, 1881.

The Telegraph in New Zealand During 1882.

The marked increase of telegraph business in the colony is shown by the following more complete statement. The number of telegrams of all codes transmitted was 1,570,189, and increase of 131,417, or 9.13 per cent. over the former year's messages. 1,361,817 ordinary and press messages were transmitted, of the value of £81, 770 4s. 8d., an increase of 145,968 messages, or 12 per cent., and £6,244 16s. 6d., or 8.26 per cent. in value. The number of telegrams of all codes and the value of each for the year, compared with the business of the previous year, will be seen from the following statement:

	Ordinary Telegrams. Number.	Press Telegrams. Number.	Government Telegrams. Number.
1881	1,094,638	121,211	222,923
1882	1,207,219	154,598	208,372
Increase	112.581	33,387	..
	10.28 p.c.	27.54 p.c.	..
Decrease	..	..	14,551
	..	..	6.52 p.c.

The telegraph cash revenue for the calendar year was £89,876 18s. 2d., and the expenditure £96,005 15s. 4d., or £6,128 17s. 2d. more than the cash receipts. But, taking credit for £756 13s. fees on money order telegrams not paid over, and £20,608 11s. 11d., the value of the Government telegrams, £111,242 3s. 1d. will be found to have been the gross earnings of the telegraph, or an apparent profit of £15,236 7s. 9d. on the year's business. 39,941 telegrams of the urgent code, of the value of £5,769 6s. were transmitted, being an increase of 7,467 messages and £1,322 7s. 8d. in value. This was an exceptionally large increase. Although the Government messages show a decrease of 14,551 in number, and £2,129 4s. 5d. in value, 208,372 Government telegrams, of the value of £20,608 11s. 11d., were transmitted during the year. It would appear, however, that greater care had been exercised in using the wires for official purposes. Within the past two years the number of Government messages has fallen off by 37,998 and £6,412 11s. 9d. in value. This tends to confirm what was alleged in last year's report, that the wires were "used too freely, if not needlessly, in some cases, for the transmission of Government messages." The average number of telegrams sent to every 100 letters for the whole colony was 13.00, against 10.79 the previous year, and this, too, in the face of an unusually large increase of letters. The mean average in 1877 was 20.71, 19.64 in 1878, and only 9.71 in 1880. Taking a few of the districts, it may not be uninteresting to compare the number of telegrams sent to every 100 letters in the years 1881 and 1882:

	1881.	1882.
Auckland	11.14	8.98
Christchurch ..	7.35	6.67
New Plymouth.	30.64	21.37
Wellington.....	22.75	18.11
Dunedin	10.27	8-55
Nelson	22.33	18.11
Westport.....	37.17	31.08

The frequency of postal communication has an undoubted influence on the business of the telegraph, and this, no doubt, is the explanation of the low averages at Dunedin and Christchurch, which possess a network of mail services and enjoy frequent and rapid communication; and the very high averages at Westport and New Plymouth, where the postal facilities are irregular and at times unreliable. 15,133 money order telegrams, for £60,263 7s. 8d., were transmitted at a cost to the remitters of £1,761 3s. 8d., or 2.92 per cent. The fees for the telegrams amounted to £756 13s., the balance representing commission. There was an increase of 892 orders and £4,747 4s. 10d. in amount, against a decrease of 256 orders for £2,819 9s. 1d., the result of the previous year's transactions. Table No. 27 gives the number and value of these orders, transmitted from offices within reach of the postal districts. Auckland sent 20.10 per cent. of the orders; Wellington, 12.43; Dunedin, 10.18; Christchurch, 10.34: Napier, 6.15; and Wanganui, 6.95 per cent. Telegraph offices were opened during the year at Boatman's, Fordell, Methven, Paeroa, Pleasant Point, Papanui, Taueira, Te Aroha, and Waihemo. Offices connected by telephone were established at Aratapu, Brunnerton, Devonport, Enfield, Fortrose, Gladstone, Heawa, Kaeo, Kelso, Kirikiriroa, Kohukuhu, Kaikohu, Mangawhare, Malvern South, Mangawai, Manawatu Heads, Macetown, Northcote, Ngapara, Ngawha, Ormond, Ormondville, Papakura, Pinebush, Pahautanui, Paparoa, Sumner, Turua, Tika, Takapuna, Taumariri, Te Puke, Temahere, Upper Montere, Whakatane, and Weston. The total number of stations which have been connected by telephone is 66. The total number of stations, including telephone stations, open at the end of the year for the transaction of public business was 264.

Mr. Swinton says it is better and cheaper to light small towns by means of electricity than by a coal-gas system. He compares the equal illuminating effects of gas and electricity in portions of the British Museum, and finds that, while the former is estimated to cost $1.22 an hour, the latter has actually cost $1.44 an hour for a total of 18,800 candle-power, using the pendulum arc lamps.

TELEGRAPHIC

.... The gross earnings of the Mexican Telegraph Company for the week ending June 18 were $3,088.

.... It is stated that $120,000, the amount needed by the Bankers and Merchants' Telegraph Company to meet interest due, was loaned by the Postal Telegraph Company.

.... The Faraday has laid the 200 miles of the eastern shore end of the Bennett-Mackay cable, and returned to Queenstown for coal. She will now proceed to lay the remainder of the deep-sea portion.

.... The Chamber of Commerce, Plymouth, England, has been corresponding with Lloyds and the Trinity House regarding the feasibility of forming a telegraphic connection between the Eddystone Lighthouse and the mainland by means of a cable.

.... New South Wales has made rapid progress in electric telegraphy. In 1873 there were but 6,521 miles of wire, 105 telegraph stations, and 565,360 messages sent. In 1882 the mileage had increased to 15,901, the stations to 345, and the number of messages sent to 1,935,931.

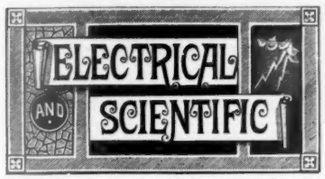
.... The Mutual Union Company has reduced rates to twenty cents for ten words to Chicago, and forty cents for ten words to St. Louis. The Western Union Company is expected to soon follow with a reduction to meet the cuts inaugurated by the Postal and Bankers and Merchants' companies. Everybody is puzzled to know who has been the heavy seller of Western Union.

.... The Baltimore and Ohio Telegraph Company of Boston has taken a charter that, with a capital of $10,000, it may construct, own, maintain or lease lines of aerial or underground telegraph, both within and without the limits of the Commonwealth. E. H. Bates is its President, and W. H. Ijams is its treasurer. The main office, which will open shortly, is to be located at at 33 Milk street, corner of Arch.

.... Corporation Counsel Taylor, in a letter to City Works Commissioner Fleeman, says that he has considered the bearing of the recently-enacted underground wire law in its relation to the request of the Fire Commissioner for a permit to rebuild and extend the Fire Department telegraph lines, and is of the opinion that no legal obstacle prevents the Commissioner of City Works from complying with the request, which he advises the Commissioner to grant.

.... It is stated that the bill now before Congress, in relation to cheaper telegraphy, proposes to largely reduce the average charges now paid by the public for telegraphic service. The reduction is to be in a ratio of 39 to 25 cents on the adoption of the bill, and to 20 cents in five years. This bill secures uniformity of charges for day telegrams within a distance not exceeding 2,000 miles. It also secures uniformity of charges without regard to the purpose for which the news is to be used. This will be a great advantage to newspapers. Under the present system there is a certain degree of censorship and manipulation of news. The pending bill removes this evil.

.... The steamship Faraday, which left London on June 23 with the second or eastern section of the first Bennett-Mackay cable on board, has been hard at work in Waterville Bay, on the Kerry coast of Ireland, laying the heavy shore end necessary at that point. When she has completed this work, she will proceed to Cork or some other convenient port for a fresh supply of coal. The last link—the deep sea section—will then be laid. The cable pool, which has Mr. John Pender for its head, is closely watching every move made by the Bennett-Mackay people. They will probably take no definite hostile action, however, in the shape of rate cutting until the success of the new enterprise is assured.



* * The Compagnie Belge and Hollandise de l'Electricite have been trying street cars provided with 108 Faure accumulators weighing less than two tons, the total weight of the car being under five tons. Athough the grades were very sharp the expectations of the company were fully answered.

* * In constructing his photo-electric battery, Dr. Borgmann places a number of U tubes in a black box having removable sides, and fills the tubes with a two per cent. solution of sulphuric acid, the light being carefully excluded. Silver plates iodized on the surface by electrolytic means are immersed in the acid. On exposure to light an electric current is set up.

* * A curious natural barometer is said to be used by the remnant of the Araucarian race which inhabits the southernmost province of Chili. It consists of the cast-off shell of a crab, which, from its curious application, is called the "Barometro Araucano." The dead shell is said to be extremely sensitive to atmospheric changes, remaining quite white in fair (dry) weather, but indicating the approach of a moist atmosphere by the appearance of small red spots, which grow both in number and in size as the moisture in the air increases, until finally, with the actual occurrence of rain, the shell becomes entirely red, and remains so throughout the rainy season.

* * Rubennick's process for the metalization of wood is to steep the wood in a caustic alkali for two or three days, according to its degree of permeability, at a temperature between 164° and 197° Fahr. The wood is then placed in a second bath of hydrosulphate of calcium, to which is added, after twenty-four or thirty-eight hours, a concentrated solution of sulphur. After forty-eight hours, the wood is immersed in a third bath of acetate of lead at a temperature between 95° and 122° Fahr., where it remains from thirty to fifty hours. After a complete drying, the wood thus treated is susceptible of a very fine polish, especially if its surface is rubbed with a piece of lead, tin, or zinc, and finally finished with a burnisher of glass or porcelain. It then looks like a metallic mirror, and is completely sheltered from all the deteriorating effects of moisture.

* * There has long been a difference of opinion among scientific men as to the origin of atmospheric electricity. Among the many causes, which have been mentioned for its presence, probably that of evaporation is the most satisfactory. It would appear that the act of separating the molecules of water, so as to convert them from a liquid to a gas, produces an electrical charge in the disengaged vapor. If the condensation of this vapor follows in point of time sufficiently close to its evaporation, the condensation of the electrical charge causes results quite sufficient to account for the high potential of the lightning flash. In this latitude, and, indeed, in all parts of the world, severe lightning is unknown, except under circumstances where the condensation of moisture shortly follows its evaporation; for example, nearly all our thunderstorms occur at the close of the hottest days of the year. So, too, severe lightning is common in the equatorial regions and almost unknown in the high latitudes; while in desert regions, where rain never falls, thunder and lightning are absolutely unknown.

* * A new electric railway signal, which seems to possess valuable features, is thus described in the Boston *Herald:* It states that by the invention now under consideration, no matter how thick the snow-storm or how dense the fog, the engineer is told in his cab whether the track is clear or not. The apparatus consists of a generator of electricity placed on the engine, and connected with the rails by a suitable device to convey the electric current to the generator. In the cab overhead is placed a gong and target, which works as follows: When a train is entering upon a section of road, if the tracks are all clear, the rails all in place, the switches and drawbridges all closed, the gong will ring a safety signal; but should there be any obstruction upon the track, or a switch or drawbridge open, the gong will strike, and the target will appear before the eyes of the engineer, upon which are the words, "Danger! Stop!" and this target will remain at danger until the entrance is made on the next section, when it returns to safety, ready for the next signal. Another most important feature is that all switches and drawbridges are locked by the train immediately upon entering the section where such switches or drawbridges exist, and cannot be opened by the switchman or drawtender until the train has passed, so that no train can be thrown from the track by a switch being opened after the safety signal has been given to the engineer before entering the section, and before he can reach the switch or drawbridge.

* * The Census Bureau has finished its competition of the aggregate wealth of the United States at the date of the census (1880), which fixes the figures at $43,64,2000,000, the principal items given being as follows:

Farm	$10,197,000,000
Residence and business real estate	9,881,000,000
All real estate exempt from tax	2,000,000,000
Railroads and equipments	5,536,000,000
Telegraphs, shipping and canals	419,000,000
Live stock, farm tools and machinery	3,656,000,000
Household furniture, clothing, paintings, books, jewelry, household supplies of food, fuel, etc	5,000,000,000
Mines, etc., with one-half the annual product	781,000,000
Three-fourths the annual product of agriculture and manufactures and imports foreign goods	6,160,000,000
Specie	612,000,000
Total	$43,642,000,000

The Pike's Peak railway, the completion of which within eighteen months is practically assured, will be, in many respects the most notable piece of track in the world. It will mount 2,000 feet further heavenward than the famous Lima and Oriva railway, in Peru, which is now in operation to a point 12,220 feet above the sea, the highest that the rails have as yet attained. The obstacles that are being overcome in its construction are among the most formidable yet presented to engineering skill. The entire thirty miles of its length will be a succession of complicated curves and grades, with no piece of straight track longer than 300 feet. The maximum grade will be 316 feet to the mile, and the average grade 270 feet. The line will abound in curves from 500 to 1,000 feet long, in which the radius changes every chain. Forty degree curves are numerous, and there will be one of forty-three degrees that will describe three-quarters of a circle. The road is being built in a most substantial manner, and will be laid with forty-pound steel. The running time will be about fifteen miles an hour. The road will cost from $12,000 to $15,000 a mile.

Mr. David Brooks, manager of the Electrical Construction and Maintenance Company of Philadelphia, has written a letter to the city authorities of Pittsburgh, in which he says: "During the past year I have laid some 2,000 miles of wires in this city. We have used the telephone and telegraph on these wires, drawn in the same pipe, since July 1, without a moment's interruption. There is no cross talk, calling up other bells, disagreeable rattling, annoyance, or disappointment. We have 343 conductors on Third street, in this city, at least 100 more than there are on both sets of poles in that street. Four years ago I laid four miles of pipe containing forty conductors, say 400 miles of wire, in the city of London, England. A letter from a person in charge of those wires, dated March 31, refers to that work in the following words: 'I am glad to report that the 40 wire cable at Clapham is working well yet." He states that the Post-office Department has asked Parliament for an appropriation sufficient to lay 200 miles of pipes. I will undertake to lay in the streets of Pittsburgh sufficient wires to accommodate all the telegraph and telephone companies so that they need not be obliged to use a single pole. 0 will guarantee these wires to work in such a manner as to reduce their complaints of interruption at least twenty-fold, and I will not charge them for the use of those wires but half what they now charge their customers." If Mr. Brooks can prove what he claims he has a fortune in his grasp, but our information concerning his buried wires does not exactly tally with his statements.

There are in Buffalo 400 arc lights, requiring the use of steam plant of about the same number of horse-power. The number of lights is increasing as in other cities, and it may be assumed that there will be 1,000 lights in use within two years The length of circuit required between Niagara Falls and Buffalo is about fifty miles. Experience has shown that from forty to sixty lights can be run on one circuit with an electromotive force of from 2,010 to 3,000 volts, but a greater number requires a current of so great intensity as to be in some danger of burning the insulation on the dynamos as at present constructed. There is no doubt the dynamos will hereafter be improved in this respect so as to permit 100 arc lights to be in the circuit. As the resistance of the circuit and consequent loss of power vary directly as the length and inversely as the area of the wire used, there will be found for every case a size of wire such that the sum of its cost and the capitalized loss of power will be reduced to a minimum. The size of wire will be less for water-power than for steam. The cost of erection, complete, of a number of circuits of proper length would be about $4,000 per circuit. The resistance would be seventy-six ohms—equal to sixteen lamps; or, assuming the very general practice of coupling, in series; a forty-light and sixteen-light Brush dynamo, the loss would be about 28 per cent.

Enough has been said to show that the power of Niagara can be transmitted to a distance of twenty-five miles with a great saving over steam, and that, with improvements in storage batteries and electro-motors, this distance can be increased with economy to from 100 to 150 miles. With further improvement in dynamos and insulating material, to permit the use of currents of higher intensity, the economical distance may be still further increased.

Cheap Electricity.

After many trials and disappointments, says the *Journal of Commerce*, electric light is nearing the point where it may successfully compete with gas and physical force for general household use. Under the recent act of Parliament a new system of electric lighting has been introduced in Colchester, England, and its initial performances are so promising as to raise the hope that at last a great public want is about to be met. The system is that of the incandescent light—like the Edison, Swan, or Maxim—but it utilizes to a degree hitherto unattempted the aid of accumulators or secondary batteries. These are distributed at convenient distances under the Colchester streets. They are reservoirs for the storage of electricity, and give out the current for the use of customers for hours after the dynamo machines have ceased to move. The machines can be run all day, and sufficient electricity can be thus accumulated to supply the light and power all night. This is a great advantage, as it insures the continuance of the current if the engines break down or are stopped for repairs.

The accumulator is to the electric light and power what the gasholder is to gaslight. If we depended for gaslight on the direct production of the retorts—without the intervening reservoir for storage—the supply would be liable to sudden stoppages and fluctuations like those which often afflict the electric light. The accumulator may now be considered indisapensble to the future use of electricity.

There are methods of measuring the amount of electricity used by the consumer; but the Colchester company prefer to charge for service so much per hour, and the expense for lighting purposes is but little more than that for gas. But the people are willing to pay more for a light which shows every thing in its true color, which does not vitiate the atmosphere, and does not cause death from a leak or a carelessly turned stop-cock. Still, economy is a very important point, and it is believed that the Colchester company can and will at an early day furnish electricity at very low rates. The cost of production there and everywhere could be much lowered if the forces of nature could be pressed into use as a motive power. With winds, tides, and waterfalls to drive the dynamo machines, the cheapness of electricity would be put beyond all competition. Even without these natural motors, it is destined to be cheapened by the free introduction of accumulators. The successful experiment at Colchester comes just in time to dispel a discouragement which has begun to be felt both in Europe and the United States.

Reminiscences of Morse's Telegraph Line from Baltimore to Washington.

The near completion of the laying of the first of the Commercial Company's cable, from Valentia to Dover Bay, calls to mind some interesting facts connected with the history of telegraph building in this country. Forty-one years ago, in the month of May, Professor Morse accomplished the aim of his life in having laid the first working telegraph line in America between Washington and Baltimore. On March 3, 1843, preceding this great event, Congress had passed a bill appropriating $30,000 for the construction of this experimental line. The debate on this question was sharp, and public opinion much divided. The resolution was finally passed, the vote standing at 90 yeas and 82 nays. New Hampshire, Georgia, Mississippi, Alabama, and Arkansas voted solidly against. New York stood 22 for, 11 against. The bill had yet to pass the Senate. Prof. Morse was then at one of the darkest periods of his life. After paying his hotel bill at Washington and procuring a ticket for New York—for he despaired of the bill passing in the Senate—he had just 37½c. left. On the day he was about to leave Washington, Miss Annie S. Ellsworth, the daughter of the Commissioner of Patents, was the first to announce to and congratulate Professor Morse on the final passage of his bill. The Professor replied: "Annie, you are the first to inform me, and now I make you a promise. When the line is completed, the first dispatch sent upon it from Washington to Baltimore shall be yours."

Mr. Morse at once turned his attention to the construction of the first telegraphic line in America; the Government allowed him a salary of $2,500 per annum meanwhile. Alfred Vail took charge of the machinery, and Ezra Cornell superintended the construction. Mr. Morse at first adopted the underground method. He ordered forty miles of a fine wire cable in New York, enclosed in a lead. A trench to lay it was dug by a plow invented for the purpose. But seven miles of wire were thus laid from Baltimore to the Relay House. Mr. Morse found, to his great chagrin, that the method was unsuitable, but not till half the appropriation had been spent. It was finally determined to lay the line on poles, with two copper wires, covered with cotton saturated with gum shellac. In May, 1844, the line was completed. The first office was at Washington, in the Capitol. The apparatus used on this first line was bulky and coarsely constructed. The relay magnets weighed 185 pounds. The coils were eighteen inches in diameter, of No. 16 copper wire, insulated with cotton thread. Mr. Morse presided at

the instrument in Washington, and Mr. Vail in Baltimore.

Miss Ellsworth was sent for by Mr. Morse, and he requested her to frame the first message to be sent over the first wire. She sent this message: "What has God wrought?" It was successfully transmitted, and the strip of paper on which it was imprinted was claimed by Governor Seymour, of Connecticut, in honor of the lady, who was a native of his State, and of the inventor who had there received his college education. The first public message sent was by Vail to Morse. The occasion was the meeting of the National Convention at Baltimore to nominate a President. James K. Polk was nominated for the Presidency, and Silas Wright for the Vice-Presidency. Mr. Morse conveyed the message to Wright, who was in Washington. Wright declined the nomination, and Morse telegraphed to that effect to Baltimore. It was a great surprise to the convention to receive this news within a few minutes of their previous action. The body refused to believe the information authentic, and waited until a committee had been sent to Washington to confer with Wright. The committee confirmed the first message by a second one. Thus the telegraph received a great boom, and came prominently into public notice.

The new line was worked merely for exhibition until April 1, 1845, on which day it was opened for public business, and a rate of transmission fixed. The first operators under this rule were Mr. Vail at Washington and Mr. Henry J. Rogers at Baltimore. The tariff was fixed by the Postmaster-General at one cent for every four characters, under whose supervision the line was placed by Congress, which voted an appropriation of $8,000 to keep it in operation during the year.

The receipts for the first four days of public operation were exactly one cent. This was the contribution of an office-seeker, who wanted to see the working of the wire for nothing at first, but who was informed that it was impossible, as the operators were sworn to do paid duty. As the offic-eseeker had but a twenty dollar bill and a cent, so he said, it was arranged that he should invest in a cent's worth of electricity. Washington asked Baltimore "4," which signal meant "what time is it?" Baltimore replied "1," meaning one o'clock. As this message included only two characters, the office-seeker was entitled to a half cent in change. As the change was not forthcoming, the new line was a half cent ahead on the legal rates. On April 5 business was brisk; twelve and a-half cents were received. On April 6, Sunday, no messages were sent. On April 7 there was a startling rise in the receipts—sixty cents. On April 8 the business was overwhelming—$1.32. This was too good to last. On April 9 the receipts dwindled to $1.04.

When the value of his invention had been fairly established, Mr. Morse offered it to the Government for $100,000. Upon adverse representations made by the Postmaster-General, the offer was refused. Mr. Morse then set to work to enlist private capital in the development of his invention. It was not an easy task.

Men with money fought shy of the new undertaking. To stir the capitalists up, a short experimental line was laid in New York City from No. 112 Broadway to a house near the Metropolitan Hotel. It was with the utmost difficulty that permission was obtained to have the connecting wires strung along the tops of the houses, the owners fearing an increase of liability of their property being struck by lightning. Mr. Ezra Cornell, afterward the founder of Cornell University, had charge of this experiment. Fifteen thousand dollars were needed to construct a line from Fort Lee to Philadelphia, which was the first link of a projected line to Washington *via* Baltimore. This money was subscribed, Mr. Corcoran, of Washington, being the first contributor. The first telegraphic charter issued in the United States was granted by the Maryland Legislature. The first company was known as the "Magnetic Telegraph Company.—*Scientific American.*

A New Primary Battery.

Two French engineers have recently brought out here from Paris a primary battery which, if it is not exaggerated, possesses considerable merit They claim for it that it will economically charge an accumulator and keep it charged; further, that it is cheap. We don't know that it will do what is claimed for it, for the trials have not yet come off. But the gentlemen connected with the enterprise are responsible men, who could have no object in promising for this battery what it will not perform. They say that in France it has done all that they claim that it is an economical plant there; and here; they have ascertained that the various elements of which the battery is composed are so much cheaper than in France that it makes the charging process almost ludicrously inexpensive. The acids and salts in question have been found to be nearly fifty per cent. cheaper here than in France.

If these gentlemen do not deceive themselves, their battery could be placed side by side with the accumulators aboard a launch, for instance. Now, these accumulators, as we know, cannot be relied upon for more than seven hours, or, rather, it is not well to let them run on for the ten hours, as it is injurious to the plates. This being the case, at the end of seven hours the secondary battery could be coupled up with the primary, and thus its powers be kept in repair. Possibly it were possible to couple up at the start, and the accumulator, by the aid of the primary battery, be kept at its best all the time.

In this way the time that could be occupied in a river voyage would, in reality be limitless, instead of as now, with the accumulator, three and a half hours; for the hold of the launch could be filled with the elements, and, if a very extensive trip had been laid out, a further quantity could be sent by rail, and be taken up at an intermediate point.

All this, no doubt, will draw a howl of derision from the skeptics; but as these gentlemen howled at the idea of crossing the Atlantic by steam, of forcing illuminating gas through street pipes, and collecting the power of a running stream for electric transmission, it isn't likely to affect the project one way or another.

In closing, we would repeat that we don't know of our personal knowledge that the apparatus will do any part of that enumerated, but we shall not be surprised if it does all. We have always believed that there was more in the primary battery than has yet been brought out, and recent improvements and experiments have confirmed us in that belief.

Should this apparatus that we have described do even a part of what is promised, it will do much, there is reason to believe, to solve the problem of ærial navigation, besides proving the wanting factor in many another scheme of importance.

The Electro-Chemical Equivalent of Silver.

We would state again, for the information of "Constant Reader," that the quantity of silver in grams deposited by a coulomb of electricity is generally called the electro-chemical equivalent, and the figure is usually given as .0011340. Under the C. G. S. (centimeter-gramme-second) system of units, the figure becomes .011340, for one coulomb is one-tenth of the C. G. S. unit of quantity. A recent determination of Lord Rayleigh, however, makes the corresponding figures .0118 and .00118. It follows that a current of an ampere will deposit 4.025 grams of silver per hour. Lord Rayleigh's result, says *Mechanics*, was obtained with great care, and is probably as accurate as we may expect to get it for some time. It will prove very useful in calibrating electric current meters. It was obtained with a silver plate voltameter containing nitrate of silver solution.

An Electric Mountain Railway.

"A project has been formed," writes a correspondent of the London *Times*, "and will, in all probability, shortly be executed, for uniting the Hotel des Alpes, Territet Chillon and the Hotel de Mont Fluery, which is situated on the steep mountain side immediately above Chillon, by an electric railway. The difference of altitude between the two hotels is 180 meters, and a few days ago the system which it proposed to adopt was put to an experimental test. Rails of a gauge of 40 centimeters were laid on a part of the mountain for a length of 50 meters, and with a gradient of 30 to the 100. Between the rails is a rack for the reception of a toothed wheel, and at each end is a curve in order to show the advantage of the proposed system over the funicular system, which does not admit of the slightest curve. The wagon carries a dynamo-electric machine, which actuates by special gearing a toothed wheel on the axle in connection with the rack between the rails. An electric and an ordinary brake enable the conductor to modify the rapidity of descent at pleasure.

Owing to the fact that several fires have resulted from their use, the fire underwriters in Boston refuse to sanction the use of incandescent lights on arc light circuits. The Weston Company is using a number of incandescent lights in this way in Boston, and it is said that they will all have to come out. It is doubtless true that several slight fires have arisen from the use of this system, but it is also true that by the introduction of suitable automatic arrangement, which throw in resistance to compensate for any light which may be extinguished, purposely or accidentally, all danger of fire may be avoided. In this connection we quote from the Boston *Herald* a communication which recently appeared in its columns:

To the Editor of the Herald: In your issue of yesterday an editorial appears on the fires recently caused in the Lawrence building and several other places by electric light wires, as claimed. At the close of the article appears this sentence: "But, in the absence of the safeguards, it must be admitted that electric lighting, under the system which caused these fires, is hardly a safe method, and hence underwriters and property owners would be abundantly justified in forbidding its use." This is all right, provided the system to be forbidden be specified, that the public may not be in doubt as to which system is dangerous and condemn all others indiscriminately. The system which caused this fire, and has caused several other similar fires in this city, is that of the New England Weston Electric Light Company, and not that of the American Electric and Illuminating Company. The American company has in the past two years established fourteen or more central lighting stations in as many different cities in New England, aggregating over 3,500 lights (more than all other companies established in the same time combined), and has never had a fire or other accident of any description whatever, or caused one dollar's damage by its wires. Will you please state these facts for the benefit of the public and to supplement and complete your editorial alluded to above.

EDWARD H. GOFF,
President American Electric and Illuminating Company.

—— Our correspondent informs us that the directors of the Louisville Exposition have just closed a contract with the Edison Company for isolated lighting for the illumination of the Exposition Building at Louisville. The company, of which Mr. Preston Hix is the agent, have agreed to furnish 3,000 Edison incandescent lamps. There will be large and handsome electric tiers in the Theater, in the Music Hall, and clusters in the naves and entrance hall, and the other lights will be fixed at regular distances all over the great building. Over 40,000 pounds of wire will be used in carrying the current from the generator to the 3,000 lamps. Each lamp is to be equal to sixteen candles. The use of the electric light in the Theater and Music Hall will minimize the danger of fire, add much to the comfort of the audiences which assemble there, and give an additional effect to the scenic display. The work is to be pushed forward at once and completed by the 3d September, when the Exposition is to be opened. The new building will be the largest one of a permanent character in which the electric light has been adopted, and when the whole system is at work, as it will be during the Exposition, there will be afforded a magnificent exhibition of electric lighting.

ELECTRIC LIGHT NEWS

—— Be satisfied when told electricity is being generated; do not try to feel how it works.

—— Messrs. Fairbanks, Morse & Co., of Chicago, have contracted with the Westinghouse Machine Company, of Pittsburgh, Pa., to control the entire sale of the Westinghouse automatic engine in the Western States and the Territories for a term of years. This contract, which is exclusive, took effect July 1st.

—— Zirconia, an extract from a mineral found in considerable quantities in the south, is quite likely to succeed petroleum coke for the manufacture of electric light carbons. Recent experiments have been highly successful, and the discoverer claims to be able to produce a carbon point two inches in length that will last for a year.—*New Orleans Times-Democrat.*

—— One of the uses to which it is proposed to put the locomotive electric headlight, we are informed by the president of the company, is to have a second illuminator placed on the rear of the engineer's cab, throwing a flood of light over the train, and so arranged that it can be turned to the right or left and be made to illuminate the station grounds when the train is at a standstill. This will be a grand improvement which the traveling public will thoroughly appreciate.

—— It is stated that in some dynamo-electric machines the cores of the electro-magnets gradually heat up, and their temperature continues to rise after the machines have stopped working. MM. Warburg and Honig have recently made experiments which lead them to believe that this heat is mainly due to magnetic friction. A core of iron was carefully magnetized by a coil and the heat generated was accurately measured. If the heat depended only on the electrical resistance of the iron to the circulation of Foucault currents, and if the coercive force of the iron was zero, the experimenters argued that they could calculate the heat generated by two cycles of magnetization. They did this, but the calorimeter showed a very different result, and they conclude that 75 per cent. of the heat arises from the magnetic friction.

—— Saratoga, like many of the other famous summer resorts, is to be benefited by the electric light. Several attempts have been made in former years to introduce electric lights here. Some few weeks ago Messrs. Goff and Downs, president and vice-president of the American Electric and Illuminating Company, of Boston, visited Saratoga for the purpose of looking the field over, with a view to establishing a central lighting station here under the American or Thomson-Houston system of electric lighting. The inducements held out were so favorable that the company decided upon building a station. Active work was commenced less than four weeks ago, since which time the work has been pushed along night and day, under the immediate personal supervision of Mr. C. E. Cushing, the American Company's representative, and Mr. Downs, brother of the vice-president of the American Company Boilers, engines, machinery, lamps and wire lines have all been constructed new, and on Monday last steam was turned on for a trial test, President Goff and Vice-President Downs having come on from Boston for that purpose. A more complete success could not have been desired. The lights were turned on in the station, Grand Union, Congress Hall, Hawthorne Spring and the new skating rink, besides several other places, and worked most successfully from the start. Hundreds of visitors from all parts of the country universally pronounced them the best electric lights they have ever seen. The hotels and business houses here are delighted with the new light, and the company will meet with splendid success.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JULY 1, 1884.

301,175 Regulating device for electric lamps; Elmer A. Sperry, Chicago, Ill.

301,192 Carbon for incandescent electric light; Nelson S. White, Canton, Mass.

301,203 Conduit for electric conductors; Lemuel Bannister and Lorin Blodgett, Philadelphia, Pa., said Blodgett assignor to said Bannister

301,351 Secondary battery; Desmond G. Fitz Gerald, Brixton, county of Surrey, England.

301,361 Electric railroad signal apparatus; Alvah W. Hall, Meriden, Conn., assignor to the Hall Railway Signal Company, same place.

301,369 Railway switch and signal mechanism; Caleb H. Jackson Allegheny, Pa.

301,417 Cable for telegraphic and other purposes; Alexander Wilkinson, London, England.

301,446 Insulator for electric wires; Albert W. Hale, Plainfield, N. J.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

Average Market Quotations of Battery Supplies for the Week Ending July 12th, 1884.

Leclanche Disque Cell, complete	$1.25
" Prism " "	$1.67
" Prisms, per pair	$1.00
" Carbon Mounted	30c.
" Jar Cover	12c
" Sal Ammoniac, in bag	8c.
" Porous Cell	$1.10
" Glass Jar	18c.
" Amalgamated Zinc	10c.
" Rubber Bands, per pair	6c.
Chlorine Battery, per cell	$1.25
Law Battery, per cell	$1.25
" Jar and its Rubber Ring	25c.
" Cover, with small Carbon sealed in	35c.
" Large Carbons, each	20c.
" Carbon Connector	12c.
" Zinc Connector	8c.
" Rubber Bolt	12c.
" Zinc and its Rubber Ring	12c.
Bergman & Haid, per cell	$1.20
Crow foot, 6x8, per cell	75c.
Callaud Zincs	30c.
" Coppers	15c.
" Jars	25c.
Sal Ammoniac, per lb	15c.
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" " bbl., lots, per lb	5½c.
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Any of our readers having copies of the old REVIEW of the TELEGRAPH AND TELEPHONE, dated March 15th, 1882 (No. 3), not specially needed by them, will confer a great favor upon us by sending them to this office, for which we will remit twenty-five cents per copy. DELANO & COMPANY,
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$10.00 PER SHARE.

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During this time the Company has paid from earnings its regular semi-annual dividends of 4 per cent., and two extra 2 per cent. semi-annual dividends, besides placing the sum of $136,343.04 to surplus account, thus making it at the present time a sound 12 per cent. investment stock.

Recently the Company has secured control of a widely increased area of territory, embracing nearly all of the United States east of the Mississippi River, and contracts for machinery and supplies have been made at far more favorable figures than ever before.

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This Stock will be sold at Par, $10 per Share, in lots to suit purchasers.

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One-fourth Cash.
One-fourth in One Month.
One-fourth in Two Months.
One-fourth in Three Months from date of subscription.

For further information, please call at the Company's office, **197 Congress Street, Boston,** or address
EDWARD H. GOFF, President.

P. S.—Subscriptions to the new stock can be sent direct to the Company's Office, or if more convenient may be sent through any of the following banks and banking houses, viz.:—

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SPECIAL NOTICE.

At a meeting of the Executive Committee of the American Electric and Illuminating Co. held to-day, it was resolved that all orders and applications which have been filed with the Treasurer for the Preferred Treasury Stock of this Company at par (as advertised above, must be completed by the payment of the first installment on or before Thursday, July 10, 1884, and that no subscriptions at par be received after that date.

EDWARD H. GOFF,
SILAS GURNEY, } *Executive Committee.*
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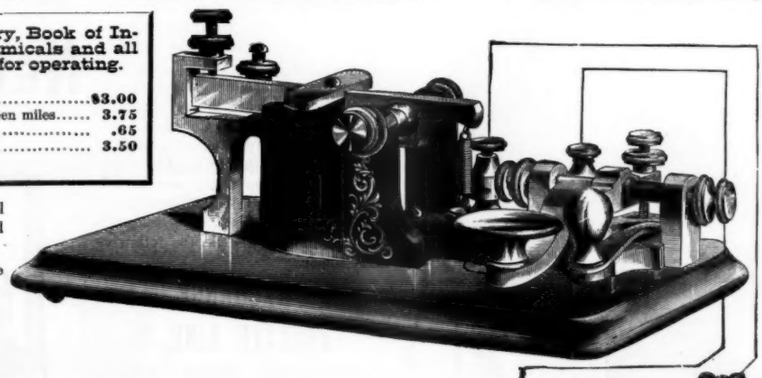

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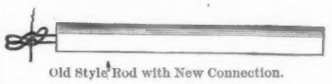

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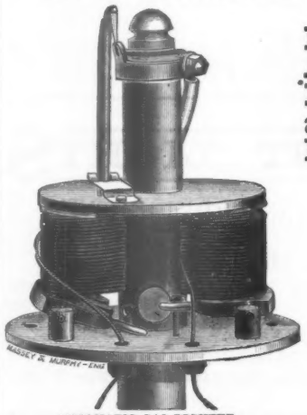

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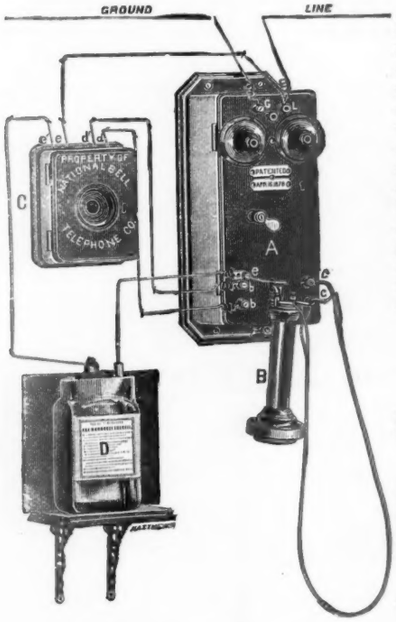

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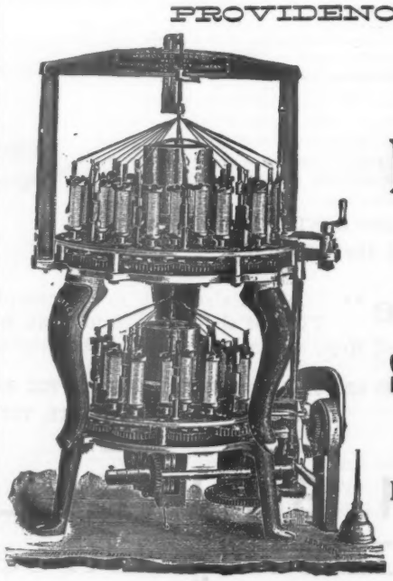

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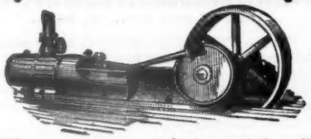

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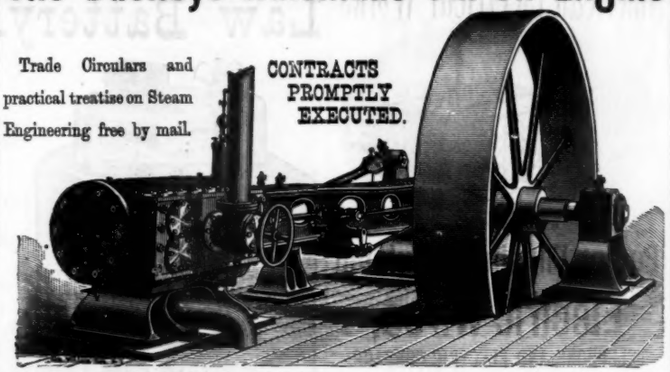

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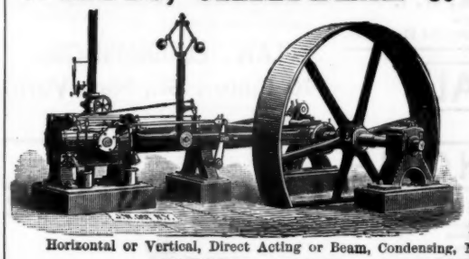

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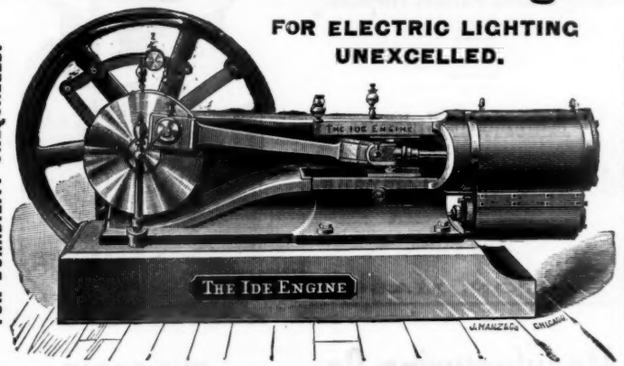

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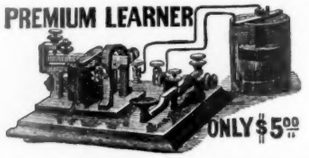

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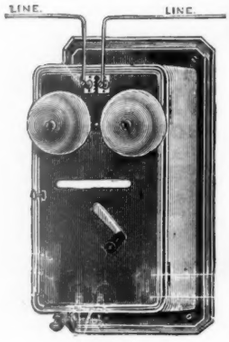

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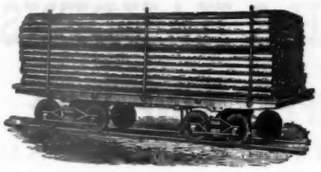

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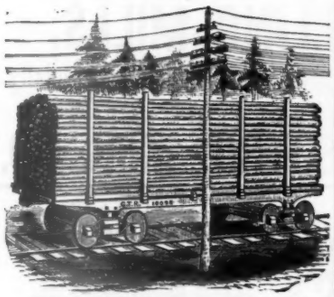

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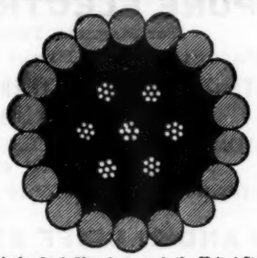

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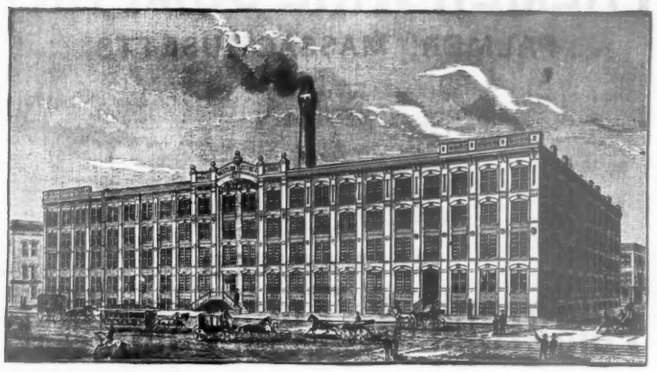

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